NORTH CAROLINA
DEPARTMENT OF CONSERVATION AND DEVELOPMENT
GEORGE R. ROSS, DIRECTOR

DIVISION OF MINERAL RESOURCES
JASPER L. STUCKEY, STATE GEOLOGIST

BULLETIN NUMBER 66

THE SCRAP MICA RESOURCES of NORTH CAROLINA

BY SAM D. BROADHURST AND LEWIS J. HASH

PREPARED AND PUBLISHED IN COOPERATION WITH
THE TENNESSEE VALLEY AUTHORITY

RALEIGH
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LETTER OF TRANSMITTAL

Raleigh, North Carolina

March 25, 1953

To His Excellency, HONORABLE WM. B. UMSTEAD
Governor of North Carolina

SIR:

I have the honor to submit herewith manuscript for publication as Bulletin 66, "The Scrap Mica Resources of North Carolina." This Bulletin is another made possible by the cooperation of the Tennessee Valley Authority.

A number of short reports on mica have been included in various Economic Papers during the past fifty years but Bulletin 43 issued in 1944 and Bulletin 49 issued in 1946 were the first major reports on mica published by the State of North Carolina. These reports dealt almost entirely with sheet mica.

The report presented herewith covers the scrap mica resources of the State. Scrap mica is used in the production of both wet and dry ground mica. The ground mica industry of the State began in a small way about 1870. During the past twenty years it has grown rapidly. This report should be of considerable value to the producers of scrap and ground mica in North Carolina.

Respectfully submitted,

GEORGE R. ROSS,
Director

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THE SCRAP MICA RESOURCES OF NORTH CAROLINA

By *Sam D. Broadhurst and †Lewis J. Hash

ABSTRACT

North Carolina produces over 75 percent of all scrap mica consumed in the United States. Most of it comes from the Spruce Pine, Franklin-Sylva, and Shelby districts. Within recent years the rapidly expanding industrial demand for scrap has resulted in an intensified mining and prospecting program in North Carolina. During the period from 1940 to 1950 annual production quadrupled and since 1930 it has increased eight fold.

Although this increased rate of production is making rapid inroads on sources of supply, reserves appear adequate to meet the demand for some years. Indicated reserves in the three major districts exceed 26,000,000 tons of ore containing an average of from 12 percent to 18 percent mica.

In North Carolina scrap mica is obtained as waste from the sheet mica industry, as a by-product of the feldspar and kaolin industries, and is mined directly from primary scrap mica deposits. Reserves are confined largely to the latter sources, especially the primary scrap mica deposits. These deposits occur as highly weathered portions of alaskites and pegmatites and along the border phases of certain granites. In general the highest quality mica occurs in pegmatites, but, because of the size and character of the average pegmatite, the available scrap is limited. The alaskites, containing a somewhat lower grade of mica but having large volumes, are the mainstay of the scrap mica industry.

Conventional washer type scrap mica concentrating plants, used for many years in North Carolina, are able only to recover economically mica larger than ⅛ inch in diameter. The finer size mica, representing up to 50 percent of the mica in some ores, is discarded as tailings along with quartz, kaolin, and semi-kaolinized feldspar. Such plants can usually operate successfully on ores containing from 6 to 8 percent plus ⅛ inch mica. The large loss of fine mica will be felt by the industry in the near future as the better deposits are worked out. A process utilizing the Humphrey Spirals, already in use in several plants, appears to be particularly effective in recovering much of the mica normally lost in a washer plant. Scrap can be concentrated by flotation, but its economic recovery by this process is dependent largely upon marketable by-products. It is now being recovered by flotation but only as a by-product of the feldspar industry.

North Carolina not only produces large quantities of scrap mica but also processes it. There are 16 concentrating plants, 6 wet grinding plants, and 5 dry grinding plants in the State. Research by the North Carolina State College Minerals Research Laboratory in Asheville has resulted in important advances in both concentrating and grinding practices.

INTRODUCTION

Scrap mica is a term loosely applied to all mica, exclusive of mica schist, which is, because of size, color, or quality, below specifications for sheet mica, and which can be satisfactorily processed for industrial use as ground mica. It is limited to the muscovite and phlogopite varieties unless specifically designated otherwise. Various breakdowns of the term are in general usage, most of them designating grade according to source or method of processing. Some of these are mine scrap, bench scrap, trimming waste, jig mica, reclaimed mica, roofing mica, wet ground mica, dry ground mica, and clay bank mica. Flake mica refers to mica mined directly from primary deposits and concentrated for grinding purposes. It is estimated that from 70 to 90 percent of the total mica content of most mica deposits is of scrap grade.

North Carolina is the leading producer of scrap mica in the United States, furnishing over 75 percent of the domestic supply. Although a small amount of chlorite is mined and ground in the State, the bulk of the scrap is of the muscovite variety. It is obtained from (1) mining, grading, trimming, and punching sheet mica, (2) produced as a by-product of feldspar mining and processing, (3) recovered during the re-

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Conventional washer type scrap mica concentrating plants, used for many years in North Carolina, are able only to recover economically mica larger than 1/8 inch in diameter. The finer size mica, representing up to 50 percent of the mica in some ores, is discarded as tailings along with quartz, kaolin, and semi-kaolinized feldspar. Such plants can usually operate successfully on ores containing from 6 to 8 percent plus 1/8 inch mica. The large loss of fine mica will be felt by the industry in the near future as the better deposits are worked out. A process utilizing the Humphrey Spirals, already in use in several plants, appears to be particularly effective in recovering much of the mica normally lost in a washer plant. Scrap can be concentrated by flotation, but its economic recovery by this process is dependent largely upon marketable by-products. It is now being recovered by flotation but only as a by-product of the feldspar industry.

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fining of kaolin, and (4) mined directly from primary deposits having high contents of small mica, the latter being referred to as "scrap mica deposits."

Over 95 percent of all scrap mica produced in North Carolina comes from three principal areas located in the western third of the State. These are known as the Spruce Pine, Franklin-Sylva, and Shelby districts. (See Figure 1.) Although scrap mica occurs in limited quantities in other areas, the known deposits are small and production is negligible.

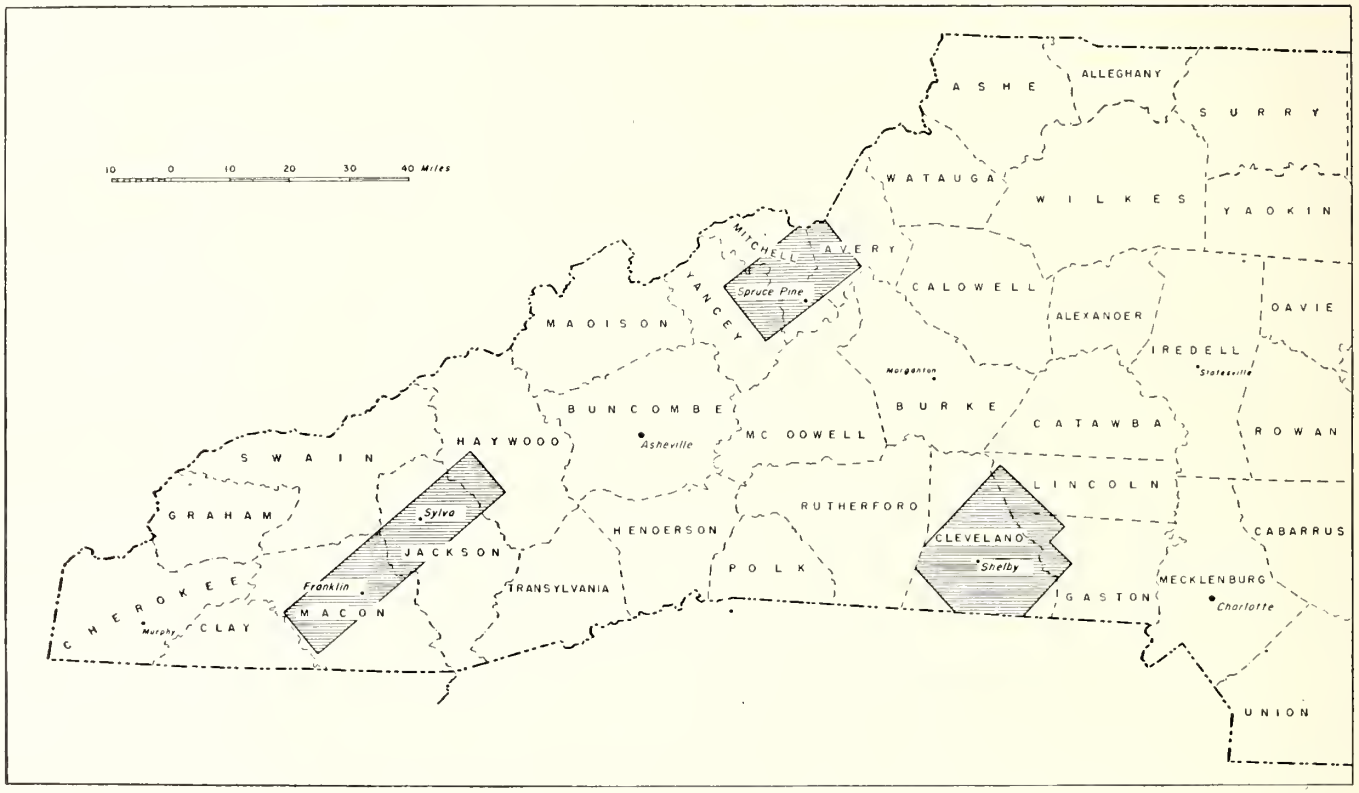


FIGURE 1. PRINCIPAL SCRAP MICA DISTRICTS IN NORTH CAROLINA

PURPOSE AND SCOPE

Scrap mica has been produced in North Carolina for more than 75 years, but only in comparatively recent times has the industry grown significantly. During the past ten years production has quadrupled and in the last twenty years it has increased over eight fold. Such rapid expansion has resulted in serious inroads on the sources of supply, making a review of concentrating practices and a revaluation of potential reserves necessary for competent future planning of the industry.

This report is an economic geological appraisal of the major scrap mica producing districts of North Carolina. Its purpose is to present a factual account of the present industry, a description of the geologic occurrence of primary scrap mica deposits, and an evaluation of overall reserves as related to future production. It is not an exhaustive work since time and finances were not sufficient for such a study. However, information presented reflects representative conditions.

This work is a compilation of three unpublished reports, summarizing field investigations carried out between 1947 and 1950 by the Division of Mineral Resources, North Carolina Department of Conservation and Development, and the Minerals Research Section, Tennessee Valley Authority. Investigations were prompted by industrial demands for information concerning the potentialities of primary scrap mica deposits as competent sources of supply to back a rapidly expanding industry. The report is designed as an aid to the future production of scrap mica in North Carolina.

FIELD WORK AND ACKNOWLEDGMENTS

Field investigations of the scrap mica deposits were carried out in two stages. The first was an investigation of the Franklin-Sylva and Shelby districts made during the summer of 1947 by Sam D. Broadhurst, geologist with the Tennessee Valley Authority, aided by student assistants Lewis J. Hash and Robert S. Houston of the North Carolina Department of Conservation and Development. The second stage was a survey of the Spruce Pine district during the summers of 1950 and 1951 and was headed by Lewis J. Hsah, geologist with the Tennessee Valley Authority. Assisting Mr. Hash were Evan K. Greene, Tennessee Valley Authority geologist, L. H. Bryant, Jr., Ben B. Hoskens, James L. Resor, Frank Dillard, R. E. Fulweiler and Thomas Henderson, student assistants, employed by the North Carolina Department of Conservation and Development.

All work was under the supervision of Charles E. Hunter, Tennessee Valley Authority geologist. The project was under the general direction of Jasper L. Stuckey, State Geologist of North Carolina, and the late H. S. Rankin, Head of the Minerals Research Section, Tennessee Valley Authority, until his death in 1949, and by his successor, Dr. Benjamin Gildersleeve. Valuable aid was given by members of the North Carolina State College Minerals Research Laboratory in Asheville and by Thomas B. Murdock, former Assistant State Geologist of North Carolina. The writers wish also to acknowledge the great assistance given by members of the scrap mica industry and property owners throughout the State.

Maps of deposits in the Spruce Pine district were prepared by the Maps and Survey Branch of the Tennessee Valley Authority. Maps of the pegmatites in the Franklin-Sylva district, prepared by members of the United States Geological Survey, were obtained from Bulletin 49 of the North Carolina Department of Conservation and Development. Production figures were derived from United States Bureau of Mines Mineral Yearbooks and from individual production records.

PREVIOUS WORK

The geology and mineral resources of portions of the areas covered by this report have been investigated previously. Of the more recent works, those of Hunter and Mattocks, Hunter, Kesler and Olsen, Olsen, and Parker are of particular interest. Others include publications by Keith, Maurice, Watts, Hunter and White, Hash and Hunter, Ries, Parker, Bayley, Strerrett, and Kesler. A selected bibliography is at the end of this report.

An unpublished map of the alaskite formations of the Spruce Pine district prepared by Hunter and Mattocks has been of great practical aid to the local mining industry and to the present investigation. Recently members of the United States Geological Survey completed detailed mapping of portions of the Spruce Pine and Shelby districts. A description of some of the pegmatites of the Piedmont region of the State is in United States Geological Survey Professional Paper 248 A.

ECONOMIC ASPECTS

Mica sold as scrap is obtained from three principal sources. These are the sheet mica fabricating industry, the kaolin and feldspar industries, and the primary or flake mica deposits. Scrap derived from the first two sources is clean and ready for processing, while that mined from the primary deposits must be separated from the gangue, washed, and dried before it is acceptable. Once concentrated, scrap from all three sources is often blended during processing. Since scrap from the first two sources is largely a by-product from other industries and cannot be controlled directly by the mica grinders, the scrap industry is dependent upon mica from the primary deposits for stabilization. Over three-fourths of all scrap comes from this source. Of major importance, therefore, are the economic and geologic factors affecting this source of supply, some of which are discussed in the following paragraphs.

EVALUATION OF SCRAP MICA DEPOSITS

Any natural occurrence of mica which may be worked profitably for its scrap content is referred to as a scrap mica deposit. Since mica occurs in various formations it is difficult to standardize a procedure for accurate evaluation purposes. Many geologic and economic variables, one depending upon another, must be

analyzed in the process. Among the more important factors to be considered are quantity, quality, availability, and proposed method of concentrating the mica.

The quantity of mica depends upon the average mica content and volume of the deposit. Most deposits average from 5 to 18 percent recoverable muscovite, although some are as low as 3 percent. Economic limits of mica content vary with size and availability of the deposit. A large easily mineable, favorably located deposit having a low mica content might be worked more profitably than a smaller one containing a higher percentage of mica but in a less favorable location ad with a more difficult ore to mine. In general deposits of the alaskite type can be worked with a lower mica content than most pegmatites because the alaskites usually contain greater volumes of ore and are wide enough to allow large-scale production.

Actual size of the deposit is relative, the total mineable ore being of primary concern. However, certain restrictions are obvious. The deposit must be of such size and shape to warrant mining by open-cut methods utilizing power driven or hydraulic equipment. Ordinarily any deposit less than 20 feet wide and 50 feet long would not be considered a competent source of scrap since it would be quite difficult to mine to any appreciable depth. The cost of mining increases rapidly with depth causing the abandonment of some narrow deposits before they are worked out. This is especially true of the smaller pegmatites. Since rock formations plunge and dip at various angles, overburden may increase rapidly at depth and will be a deciding factor in the economics of such deposits. An average deposit is from 50 to 100 feet wide and several hundred feet long, although much larger ones occur.

The quality of mica is an important consideration. The mica must be relatively free of clay, stain and other impurities that would discolor or increase the weight of the finished product. Biotite is acceptable up to approximately 2 percent of the total mica content. The crude mica must be readily separated from quartz and other gangue, although a small amount of quartz is permissible in the concentrate. The size of the mica is not of major importance, although some processors believe that pieces smaller than ¼ inch do not always grind as well as the larger ones. This idea, although widely accepted by grinders, has not been borne out by test work. Data obtained from controlled grinding tests, both in the Minerals Research Laboratory and in actual plant operation, indicates that size is of little importance in grinding efficiency or quality of products. Mica suitable as sheet or punch is highly desirable in a deposit since it is easily recovered by screening at little cost.

The commercial aspects of a scrap deposit are directly dependent upon the availability of mica. This covers a broad field which includes the ease with which the scrap can be mined and separated from the gangue and the accessibility of the deposit. Hard rock deposits are seldom economical because of high mining and milling costs. The most desirable type of deposit is well kaolinized and contains a relatively uniform mica content throughout. Such a deposit is mined easily, does not require excessive crushing and screening, and affords an even flow of mica through the plant.

The deposit must also be accessible to suitable transportation facilities and to the plant site. A long haul or much access road building would be too expensive to warrant working the average deposit. However, the economic values vary radically with location. If it is in an area where a plant is already in operation, the problem is chiefly one of mining and haulage. If a plant must be constructed, reserves must be such as to warrant the investment. In most instances a deposit should contain sufficient reserves for two or more years' production prior to the erection of a plant.

One of the factors which is gaining rapidly in importance in appraising scrap mica deposits is the proposed methods of concentration. In most conventional scrap washer plants, mica smaller than eight mesh cannot be recovered profitably. As a result, many plants are able to concentrate only about 40 percent of the mica in the ore. In some cases the recovery is as low as 20 percent. Therefore, from 60 to 80 percent of the available mica is often lost. Such losses will become major economic factors in the near future as readily available reserves of coarse mica are depleted. If the spiral method of concentration is to be used, then the size is of lesser importance, and initial plant costs and efficiency of mica recovery are primary factors. Spiral concentration methods require controlled grinding but often recover up to 80 percent of the mica in the feed.

Concentration by flotation may result in possible higher recoveries than the washer plant or spiral methods. However, the process is more expensive and requires closer control. The economic recovery of scrap mica alone by flotation is in some doubt. However, it is being concentrated by this method as a by-product of the feldspar industry.

MINING AND CONCENTRATING

MINING

The size, attitude, and irregularity of most scrap mica deposits prevent the employment of large-scale or very systematic mining procedures. Open-pit quarry methods are used, the ore being mined hydraulically or by power-driven equipment, or by a combination of the two. Overburden is stripped ahead of the working face by bulldozer.

Hydraulic methods are used when possible. In this type of mining, water under pressure is directed against the quarry face by means of jets. The ore, broken up by the force of the water, is washed from the face into a sump from which it is flumed to the plant. In semi-kaolinized material, black powder is used to fracture the ore prior to its being subjected to the hydraulic process. Equipment consists of one or more nozzles or jets, hose or pipe, and water under moderate pressure. Two or three men are all that are necessary for the operation. In some cases a bulldozer is employed to push the ore from the face into the sump, and the ore is then flumed to the plant.

When hydraulic methods are not practical, power-driven equipment is employed. Mining is carried out in one of three ways: a bulldozer scrapes up the ore and pushes it into loading bins, from which it is loaded into dump trucks; the ore is loaded directly from the face into trucks by power shovels; or tractor pulled drag pans mine and haul the ore. Where pow initial and operating costs. However, a deposit must more flexibility of action and can mine deposits unfavorably situated for hydraulic mining.

The advantage of hydraulic mining is in the low initial and operating costs. However a deposit must have a suitable topographic location, be near a satisfactory water supply, and have ample reserves to supply a plant for two or more years. Its principal disadvantages are that the plant must be moved quite often, the water is subject to freezing in winter, and grinding plants cannot be located economically at the concentrating plants. By using power-driven equipment, a greater number and smaller deposits can be worked profitably, a steady supply of ore assured, and the plant located at a central point favorable to water supply, ore deposit, and transportation facilities. Many of the scrap mica deposits located favirably for mining by hydraulic methods have been worked out, and most of the larger operations utilize power-driven equipment.

CONCENTRATION

Scrap mica is hauled or flumed from the mines to concentrating plants, where it is washed and separated from gangue materials. The process is carried out by one of two methods: differential crushing and screening in washer (jig) plants, or by differential grinding and utilization of the Humphrey Spirals for concentration. The latter method has been perfected recently and, although must more effective in many instances. is not as yet in widespread usage.

WASHER PLANT

Conventional washer plants are simple in design and often of temporary construction. In general they consist of a series of roll crushers and trommel screens, a rotary drier, and storage facilities. Electric or Diesel power is used. Ore is moved through the plant by gravity methods or bucket elevators. Large amounts of wash water are required, and the accessibility of a suitable supply often determines the plant location.

The flowsheet of a typical washer plant is shown in Figure 2. If the mine-run ore is blocky, it is first crushed to minus two inch sizes in a jaw crusher and then washed through a series of roll crushers and trommel screens. Quartz and feldspar are quite brittle and when passed through the rolls are reduced to fine sizes. Mica, being flat and platy, is affected little. After reduction in a roll crusher, the ore moves onto a trommel, equipped with ⅛ inch screens. The coarse particles, principally mica, are retained on the screen, and the fine mica. quartz, feldspar, and clay are washed through and discarded. This procedure is repeated one or more times, until as much of the quartz and feldspar has been removed as is practical. The concentrate is then dried in a wood or oil-fired rotary drier. There is a tendency for small pieces of quartz to adhere to wet mica. Therefore, after being dried, the concentrate is passed through a final set of rolls and screens prior to its being sent to storage. Concentrates are essentially free from most impurities with the exception of quartz, which may be present in amounts ranging from 5 to 10 percent.

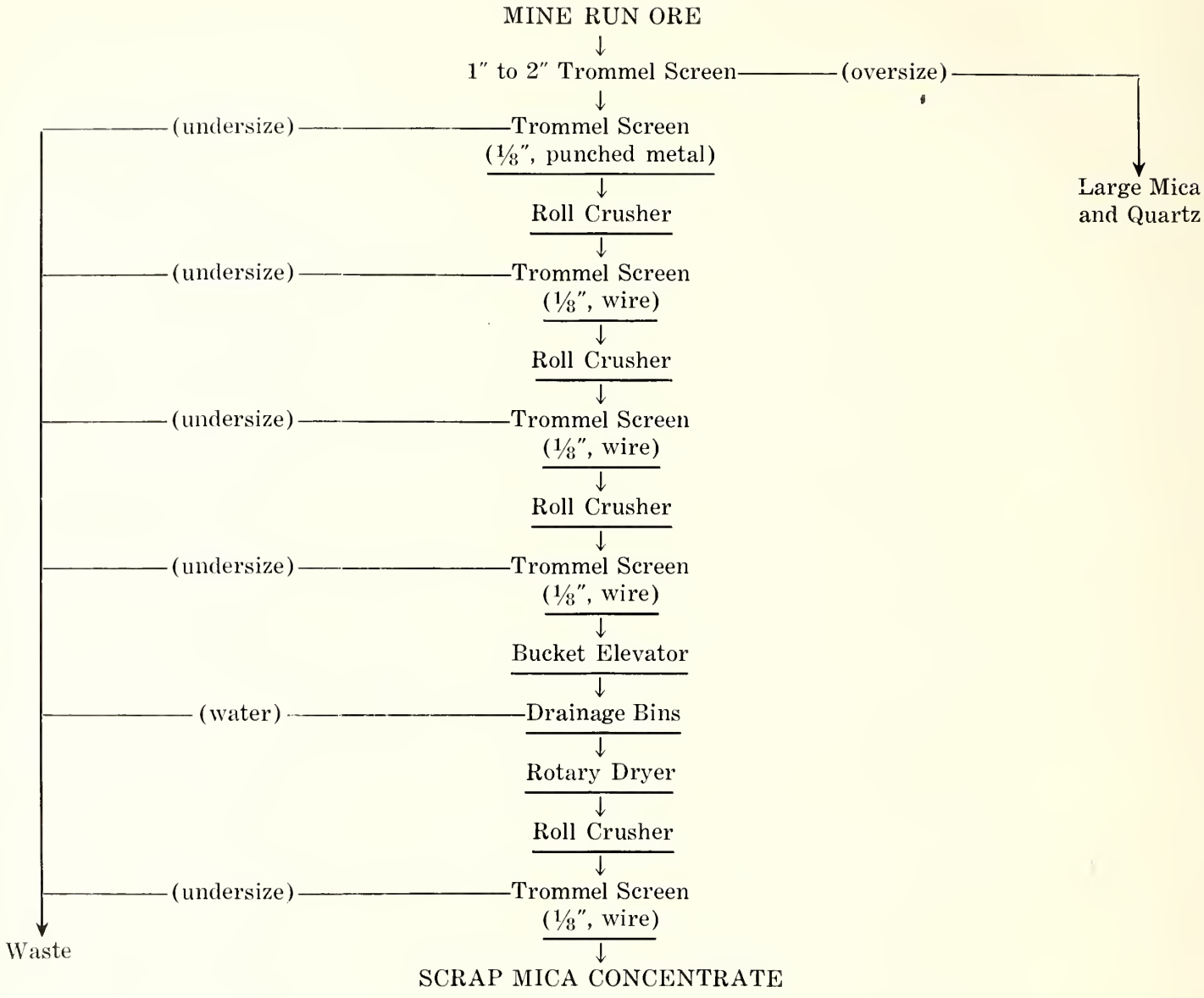


FIGURE 2. FLOWSHEET FOR CONVENTIONAL SCRAP MICA WASHER PLANT

The washer plant is a relatively low cost unit and is quite effective for the recovery of plus ⅛ inch mica. It has been used successfully for many years in North Carolina. However that mica finer than ⅛ inch, often representing up to 50 percent of the mica in an ore, cannot be recovered economically in the conventional washer plant and is discarded.

HUMPHREY SPIRALS

Within the past few years a new process for the recovery of scrap mica has been developed by the North Carolina State College Minerals Research Laboratory at Asheville. It consists of reducing the ore to approximately 16 mesh in a rod mill and passing it over Humphrey Spirals. A general flowsheet is given in Figure 3.

This process must be more closely controlled than that used in the washer plant, but when operating properly will recover approximately 80 percent of the mica in the ore. Four mineral concentrating plants in North Carolina are now using spirals to recover scrap mica. The process is expected to be adopted more widely in the future.

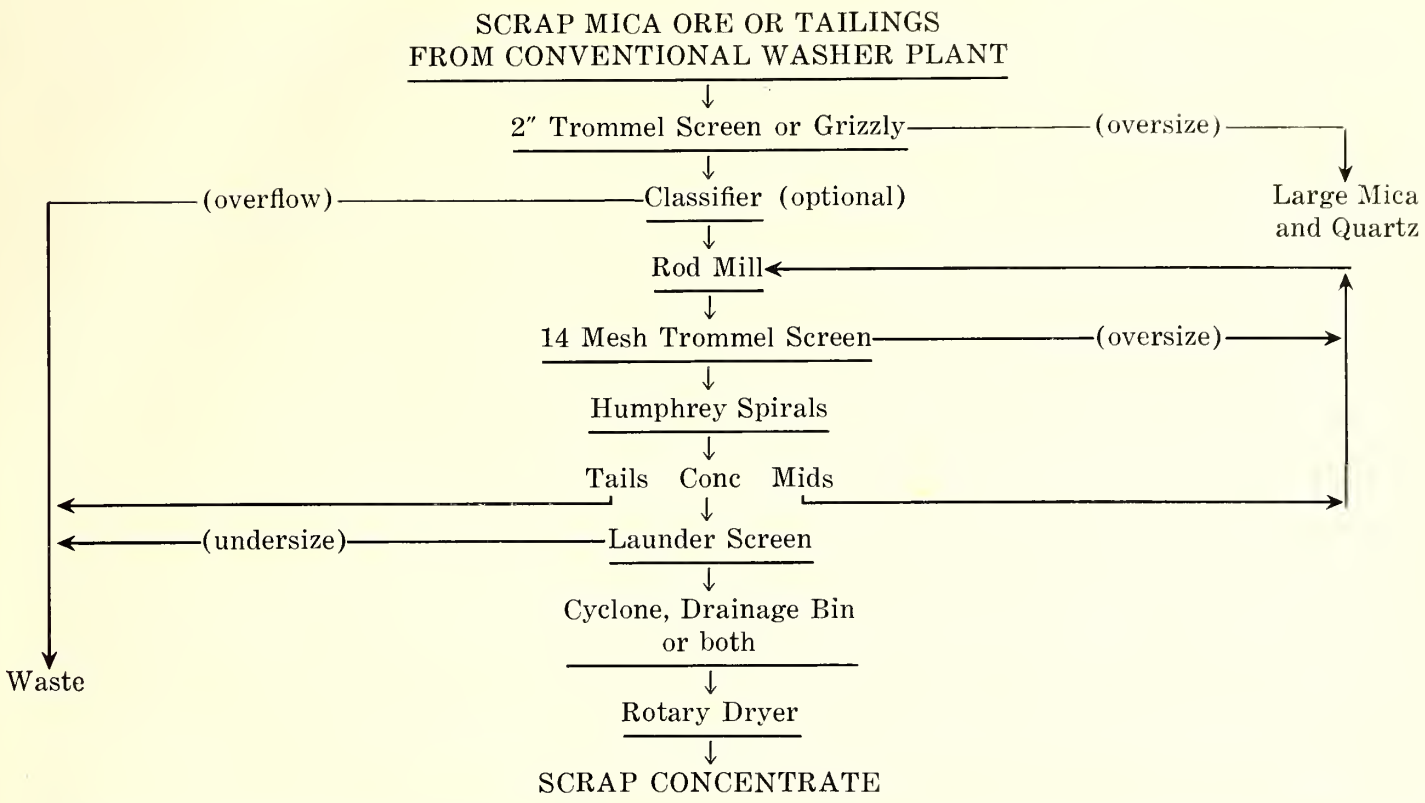


FIGURE 3. GENERALIZED FLOWSHEET FOR HUMPHREY SPIRALS SCRAP MICA CONCENTRATING PLANT

PROCESSING AND SPECIFICATIONS

Since mica sold as scrap comes from a variety of sources, individual lots differ as to condition and quality. Requirements for such mica, prior to its being processed, are not rigid although some restrictions are necessary. It must be of the muscovite or phlogopite variety, washed free of clay and mud, have a minimum amount of staining, and contain little or no grit. Biotite is increasingly detrimental if present in amounts exceeding 1 percent, since it results in a discolored product unsuitable for many specialized uses. Two percent is usually the maximum amount acceptable. In some instances small scrap derived from unweathered ore resists delamination to such a degree that it presents processing problems, while that in extremely weathered deposits may have excessive stain.

Scrap mica is processed by being ground to a powder meeting certain size, color, and bulk lensity specifications. Blending of the raw scrap is often necessary to produce the desired product. In preparing the mica for market three grinding processes are used: wet grinding, dry grinding, and micronizing. The marketed product is classified roughly according to the grinding process used in its preparation, which in turn indicates quality, properties, and general price brackets.

WET GROUND MICA

Scrap which has been processed by wet grinding methods is a high quality material of exacting size, sheen, and color specifications. It is prepared by a batch grinding process in which considerable technique is required on the part of the operator to make the desired product. This process is described in some detail by Horton as follows:

> "Wet grinding is done in chaser mills consisting of annular steel or wooden pans up to 10 feet in diameter and 40 inches in depth, in which wooden rollers rotating on horizontal arms revolve about a central shaft. The bottoms of the pans are lined with and the rollers made of end-grain wooden blocks, oak, maple, and black gum being preferred. The mills may be equipped with 2,

3, or 4 rollers ranging in diameter from 30 to 40 inches. The roller faces are generally 20 to 24 inches wide, and the rollers are so arranged that they can be raised or lowered according to the depth of charge in the mill. Steel plows following each roller turn the charge to present new material to the grinding action of the succeeding roller and to keep the mica in the path of the rollers. The mills usually operate at 20 to 40 revolutions per minute, varying with the dimensions of the mill and the weight of the charge, and consume about 20 horsepower. Complete grinding of 1-ton charge of mica requires 4 to 8 hours; the time varies with the physical character of the mica and speed of the mill. The mica, unless it is clean shop scrap, is washed thoroughly to remove fine rock and dirt before it is ground. . . . Grinding is started without water, but as the mica breaks up water is added gradually to form a stiff paste and the grinding is continued under carefully regulated conditions until the charge is completely ground. The friction generated in the charge produces so much heat that the water actually boils, and care must be taken to prevent the mica from becoming too dry and 'burning.' The water content of the charge must therefore be watched carefully. If too much water is used proper grinding is precluded, and if too little is used, the mica will burn and lose its sheen.

The ground charge is sluiced from the mill into wooden sand boxes or launders, where the gritty impurities and coarse mica settle. The overflow carries the fine mica to wooden vats, where it is allowed to settle and the clear water is siphoned off. The mica sludge is then transferred direct to steam tables, or it may be filter-pressed before drying. The dried mica is run over a vibrating scalper screen, usually of about 60- or 80-mesh, to remove heavy particles that would injure the fine silk cloths of the bolting machines on which it is sized. The bolting machines are similar to those employed in bolting flour; replacement of the expensive silk cloths is a large item in the cost of screening mica. The mica is bolted through 160- to 300-mesh cloths according to specifications, and the oversize is returned to the mills for regrinding. Normally 80 to 85 percent of the mica is recovered as a finished product. In all of the operations great care is exercised to keep the mica clean and free from oil and iron stain.

A grinding plant with three mills makes about 2 tons of finished product in a 10-hour day. . . . About 85 horsepower is required to operate the mills, pumps, elevators, and screens in such a plant. . . ."

The process described above, although slow and cumbersome, has been used with little basic change for many years.

Recently, the North Carolina State College Minerals Research Laboratory, in cooperation with the Tennessee Valley Authority and private industry, has developed a continuous method for wet grinding mica which has proved very effective on some micas. This patented process is now being used under exclusive license in one plant in North Carolina.

Specifications for wet ground mica vary with the consumer. In general the material must be very white, have high reflective properties, and be within given size ranges. Some slightly colored mica is marketed. Most requirements specify that certain percentages pass 80, 160, and 325 meshes, the latter sizes being more widely designated. A bulk density not to exceed 11 pounds per cubic foot is desired.

DRY GROUND MICA

In the preparation of dry ground mica the raw scrap is reduced to proper size in hammer or attrition mills, and screened by means of vibrating deck screens. Hammer mills are the more widely used. The process is simple and large volumes of scrap can be handled rapidly and at relatively low costs. In general a lower grade of scrap can be used in preparing dry ground mica than that required for wet ground.

Most specifications require size ranges between 20 and 250 meshes, 80, 140, and passing 140 being standard in some plants. A bulk density of less than 18 pounds per cubic foot is usually required.

MICRO MICA

"Micro Mica" is an extremely fine powder derived by a special grinding process referred to as micronizing which involves the use of steam under high pressure. As described in the July 1947 issue of *Rock Products*, the process consists of ". . . injecting high pressure super heated steam into a shallow, circular, grinding chamber which contains a steady flow of mica already reduced to ⅛ inch size or finer. Steam enters through tiny jets set at an angle to whirl the mica around and cut across the rotating mica. This reduces it to a very fine powder. . . . As the particles become finer, the centrifugal force no longer keeps them to the

outside and they gravitate toward the center where they are collected." The resulting material is a flat white powder theoretically passing 1000 and 3000 mesh. "The 1000 mesh mica has an average particle size of 10 to 20 microns in diameter while the 3000 mesh mica has an average particle size of 5 to 10 microns in diameter."

PROPERTIES AND USES

When ground to a powder, scrap mica has unique properties which make it a highly desirable product suitable for many industrial uses. Among the more important properties are its ability to retain its flat platy structure after extremely fine grinding, which results in a powder having great covering power, and its retention of a high luster after water grinding, giving it excellent reflective and certain lubricative properties. Its relative inertness, insulative properties, toughness, flexibility, and color are also important assets.

Wet ground mica is usually white, has a greasy unguent feel, and a pronounced sheen. Individual particles are highly polished and have rather smooth edges. Some of the more outstanding physical properties, as presented in Technical Bulletin 1 of the Wet Ground Mica Association, are shown in Table I.

TABLE I—PROPERTIES OF WET GROUND MICA

pH	6 to 8
Hardness	2.5
Particle size, range	2 . . 100 microns, 100 to 325 mesh
Specific gravity	2.7 to 3.0
Pounds per cubic foot	10 to 11
Wet bulking value	0.0426 gallons per pound
Index of refraction	1.58
Melting point	2800°F
Oil adsorption, range	40 - 60 percent
Sphericity factor	0.1
Color	white to grey or green or pink
Effect by common acids	slight

Dry ground mica is a rather flat white powder having little luster. Individual particles have rough hackly edges and little or no polish on flat surfaces. Color and size ranges are not too closely controlled. However dry ground mica retains many of the properties of wet ground mica, and is available at much lower costs. Its adaptability to a wide variety of industrial uses is indicated by the fact that it accounts for about 85 percent of all mica ground in the United States.

The uses of ground mica are too numerous to be discussed in detail and, therefore, only the more outstanding are given. Most of the wet ground and considerable amounts of high grade dry ground mica are used in the manufacture of paint. The wallpaper industry consumes sizeable amounts of wet ground mica, using it in design printing. Dry ground mica is used principally in the manufacture of roll roofing, and over 50 percent of the total production of dry ground mica is marketed for this purpose. Purer grades of both wet and dry ground mica are utilized as inert fillers and dusting powder by the rubber industry. Other uses of ground mica are in the manufacture of plastics, cable and telephone wire insulation, artificial snow, oil and axle grease, pipe line enamels, textiles, bonded glass, wallboard cement, asphalt landing mats, house insulation, in annealing, and oil well drilling.

During the period 1945-1949 the approximate distribution of sales of ground mica to the various leading industries, by percentages of volume sold, as computed from the United States Bureau of Mines Yearbooks is as follows:

Roofing	53%	Paint	15%
Wallpaper	4	Plastics	2
Rubber	8	Miscellaneous	18

Within the past few years the uses of ground mica increased considerably, and many new uses are expected to be developed. Of particular note is the increased consumption in wallboard joint cement and oil well drilling muds. Considerable research is in progress on utilizing scrap in the preparation of a mica board for certain uses in the electrical industry.

PRODUCTION AND VALUE

In the United States raw scrap mica is obtained from both domestic and foreign sources. However, imports represent less than 10 percent of the scrap consumed. During the period 1945-1949, annual imports of scrap averaged only 4,762 tons valued at $62,697.00. Of this, approximately 1,834 tons were of the phlogopite variety. Canada, India, and the Union of South Africa are the chief sources of imports.

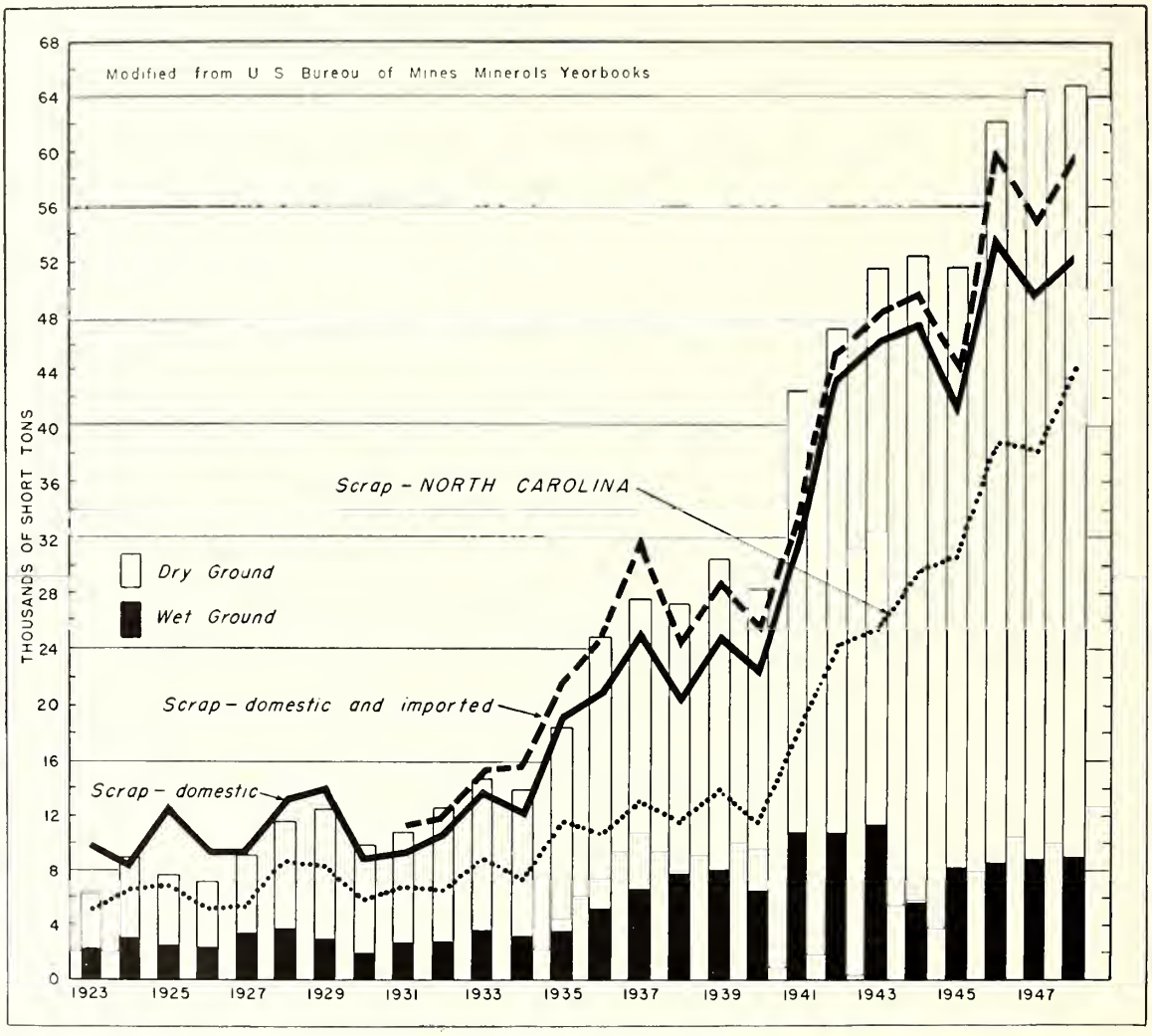


FIGURE 4. SCRAP AND GROUND MICA SOLD IN THE UNITED STATES, 1923-1948.

Approximately 91 percent of the mica consumed by grinders is of domestic origin. North Carolina furnishes over 75 percent of the raw scrap used to manufacture ground mica in the United States and is followed by South Dakota. Comparative production figures by States are shown in Table II.

TABLE II. AVERAGE ANNUAL PRODUCTION OF SCRAP MICA IN THE UNITED STATES BY STATES FROM 1945-1949

State	*Tons*	*Value*	*Unit Value*
North Carolina	35,533	$814,800	$22.95
South Dakota	1,524	36,450	23.65
Other States	8,839	116,110	13.70

A breakdown of ground mica production in the United States for the period 1945-1949 is given in Table III. Of particular interest is the ratio of wet ground to dry ground production tonnages as compared with corresponding values.

TABLE III. GROUND MICA (Including mica from kaolin and schist) SOLD BY PRODUCERS IN THE UNITED STATES, 1945-49, BY METHODS OF GRINDING

Year	Dry Ground		Wet ground		Total	
	Short tons	Value	Short tons	Value	Short tons	Value
1945	43,686	$1,243,075	8,120	$ 752,894	51,806	$1,995,969
1946	53,908	1,582,974	8,205	933,044	62,113	2,516,018
1947	55,731	1,852,768	8,809	1,114,945	64,540	2,967,713
1948	55,494	2,035,618	9,148	1,197,014	64,642	3,232,632
1949	49,133	1,850,400	7,260	1,010,556	56,393	2,860,956

A summary of the production of scrap and ground mica in the Untied States from 1923 to 1948 is shown graphically in Figure 4. North Carolina's dominant position in the scrap mica industry is clearly indicated.

Prices for raw scrap and ground mica from North Carolina as quoted by the *Engineering and Mining Journal Metal and Markets Report* for November 1952 are as follows: Scrap—$32 to $35 per ton depending upon quality. Wet Ground—$140 to $155 per ton depending upon fineness and quality. Dry ground—$32.50 to $70.00 per ton.

SCRAP MICA RESOURCES OF NORTH CAROLINA

GENERAL GEOLOGY

Geology relating to the occurrences of scrap mica in North Carolina is for all practical purposes identical with that of the occurrences of sheet mica, feldspar, and kaolin, since all are a part of the same rock formations. Detailed accounts of the various relationships have been well covered in other publications (see Bibliography) and are not considered as being within the scope of this report. The descriptions which follow are therefore for general orientation purposes only.

The scrap mica districts, although quite widely separated geographically, have somewhat similar geologic settings. All are located within a great complex of metamorphic and igneous rocks which underlie most of the Mountain and western Piedmont provinces of the State. The region has been subjected to the several major periods of folding, faulting, intrusion, uplift, and erosion associated with the formation of the Appalachian Mountain system, of which it is a part. Throughout the districts gneisses, schists, and granites are the predominating rock types.

METAMORPHIC ROCKS

The most extensive of the metamorphic rocks are mica gneisses and schists, composed principally of muscovite, biotite, quartz, and some garnet. These occur interlayered in varying proportions with hornblendic gneisses and schists and are generally considered to represent sediments of pre-Cambrian age which have been altered greatly by regional metamorphism. Zones of kyanite, sillimanite, and graphite schists occur sporadically, as do lenses of dolomite. The major trend of the gneiss-schist series is northeastward and the dip southeastward, although extreme variations occur locally. Igneous solutions have invaded the metamorphic rocks over wide areas, causing much change in the composition and structure of the formations.

IGNEOUS ROCKS

Large bodies of granite and allied silicic rocks were intruded into the gneiss-schist series, in some instances highly disrupting it, and in others absorbing large quantities of it. Although age relationships of the rocks have not been established definitely, at least two stages of intrusion of silicic rocks are recognized. One is considered to be pre-Cambrian and the other late Paleozoic, the latter apparently accounting for most of the pegmatitic activity which resulted in the formation of the major deposits of feldspar and mica. Ultramafics, principally dunite and diabase, also intrude the metamorphic series, but in much smaller quantities

than do the granitic rocks. The age of the dunites has not been established definitely, although it is generally conceded to be pre-Mesozoic. The diabase is considered as belonging to the Triassic or a later period.

Of particular importance in the formation of scrap mica deposits are the silicic rocks and their relationships with the surronding schistose formations. These intrusives occur as quartz veins, aplite dikes, pegmatites, large coarse-textured masses termed "alaskite," and massive granite bodies. Of these the latter three are important sources of scrap mica.

PEGMATITES

Pegmatites are elongated, somewhat tabular dike-like bodies, thought to represent a late stage in the intrusion of silicic rocks. They transect most of the other rocks, including the granites, alaskites, and rocks of the gneiss-schist series. Those occurring in the granitic rocks appear as instrusives in some places and as segregations in others. These bodies are usually quite coarse grained, and are composed principally of feldspar, quartz, and mica. For the purpose of this report they are limited to the smaller type of silicic instrusive, usually ranging in width from less than an inch to a hundred or more feet and in length from a few feet to as much as 500 feet. They occur as individual deposits within the gneisses and schists, within the alaskite formation into which they sometimes grade, and in and near the granites. When associated with the latter they are especially prevalent along border zones.

The emplacement of the pegmatites was probably the most important phase of igneous activity directly responsible for economically valuable deposits of mica and feldspar. Not only did the rising solutions form individual deposits of extremely high-grade mica-bearing pegmatites, but, in passing through certain of the alaskites and granites, enriched them to such a degree that their commercial value was enhanced greatly.

ALASKITE

"Alaskite" is a term here applied to a coarse-textured granitic rock which is common in the Spruce Pine district. It is composed principally of feldspar, muscovite, and quartz, very few of the ferromagnesian minerals being present. A general mineralogical composition is as follows: plagioclase feldspar 40%, microcline feldspar 20%, quartz 30%, and mica 10 to 20%. Garnet and biotite are found in very small amounts in most of the rock, the amounts increasing as contacts with the country rock are approached. Its texture is finer than that of a pegmatite but coarser than that of most granites.

Although the rock does not fit exacting scientific specifications for alaskite, the name was applied to the material some years ago by Hunter and has been accepted generally by the local mining industry. It is retained here, not as a strict classification of a rock type, but as the most practical term, since the rock approximates the requirements for alaskite and the term is already in common usage among the miners and operators within the Spruce Pine district.

GRANITE

Granite occurs in limited amounts in all of the scrap mica producing areas, being especially prevalent in the Shelby district. When compared with pegmatite and alaskite, granite is a medium to fine-grained rock and, like them, is composed principally of feldspar, mica, and quartz. However, the iron-bearing minerals such as biotite, garnet, and hornblende are much more common. Granite occurs as somewhat irregular masses ranging in diameter from a few feet to several miles. Two or more ages of granite have been recognized in the districts.

WEATHERING

Throughout the scrap mica districts of the western Piedmont province, the rocks are usually highly weathered, at least to local drainage levels and often to greater depths. In many places weathered materials extend 30 to 50 feet below the surface and could be expected to extend to a hundred feet or more. Outcrops are for the most part confined to areas adjacent to the larger streams.

In the Mountain province where erosion is usually quite rapid, most of the rocks are relatively fresh and outcrops are numerous. The greatest degree of weathering is along the lower slopes and in the major valleys where erosional forces have been delayed temporarily. In such areas the rocks are often weathered to depths of 50 or more feet, 10 to 20 feet being common. Deep weathering in the mountains is usually quite restricted, but has been encountered to depths of 200 feet in some mines.

THE SCRAP MICA INDUSTRY OF NORTH CAROLINA

HISTORY AND PRODUCTION

The early history and development of the scrap mica industry in North Carolina is associated closely with kaolin and sheet mica mining, but actual records are scarce. The first scrap mica grinding plant is reported to have been built on Beaver Creek near Spruce Pine, about 1870. Shortly after, Mr. David T. Vance erected a grinding plant at Plumtree, and soon other plants were built near Penland, North Carolina and Richmond, Virginia. In 1908 the English Mica Company constructed a grinding plant in Spruce Pine. Mica used by these early plants was waste from sheet mica mining and processing, much of it being obtained by reworking old sheet mica mine dumps. Soon after the close of the last century most of the old dumps had been worked out, and scrap mica mining developed rapidly.

In 1907 the Franklin Kaolin and Mica Company was operating a kaolin and mica recovery plant at the Iotla Mine in Macon County. This plant was soon taken over by the Southern Mica Company. In 1910 Mr. Charley Gunter constructed the first scrap mica concentration plant in the Spruce Pine area and furnished the English Mica Company with his product. Since these early beginnings the scrap mica industry has grown rapidly. Scrap is now produced directly from 16 scrap mica concentrating plants and as a by-product from 3 kaolin recovery plants and 4 feldspar flotations plants. It is processed by 6 wet grinding plants and 5 dry grinding plants operating within the State. The rapid rise in productive ability of the industry is in a large part due to its ready adaptation of new mining methods and techniques, its capitalization on results of geologic investigations of the deposits, and on research studies on new concentration and grinding practices.

The development and present status of the scrap mica industry in North Carolina are best reflected by records of production. Table IV shows the production of scrap in North Carolina for the period 1901-1950. Of special interest is the rapid increase in tonnages and values since 1930. During World War II a sizeable amount of high-grade scrap was produced as a result of the Government sponsored sheet mica program.

TABLE IV. SCRAP MICA PRODUCTION OF NORTH CAROLINA 1901-1950

Year	*Short Tons*	*Value*	*Value/Ton*	*Year*	*Short Tons*	*Value*	*Value/Ton*
1901	1,775	$ 14.200	$ 8.00	1925	7,095	$124,818	$17.59
02	324	2,219	6.84	26	5,314	124,048	23.34
03	300	2,400	8.00	27	5,409	113,670	21.01
04	341	3,410	10.00	28	8,739	132,119	15.12
1905	275	3,375	12.27	29	8,346	153,722	18.42
06	1,129	11,940	10.58	1930	5,904	97,600	16.53
07	1,371	15,250	11.12	31	6,872	84,818	12.34
08	1,308	13,330	10.25	32	6,237	71,842	11.52
09	2,607	26,178	10.04	33	8,968	102,830	11.47
1910	3,074	37,237	12.11	34	7,255	101,985	14.06
11	2,347	29,798	12.69	1935	11,831	153,553	12.98
12	2,492	36,675	14.72	36	10,840	131,138	12.10
13	2,729	37,239	13.65	37	12,988	209,212	16.11
14	1,789	23,900	13.36	38	11,959	161,598	13.51
1915	2,840	33,943	11.95	39	13,913	184,377	13.25
16	2,755	41,880	15.20	1940	11,595	173,327	14.95
17	2,180	34,134	15.66	41	18,234	268,596	14.73
18	1,046	12,930	12.36	42	24,145	485,560	20.11
19	1,639	32,338	19.73	43	25,295	516,637	20.41
1920	2,823	91,653	32.47	44	29,775	750,285	25.20
21	1,353	30,496	22.54	1945	30,682	709,334	23.12
22	4,205	65,923	15.68	46	39,100	887,901	22.78
23	5,005	95,128	19.01	47	38,655	844,086	21.83
24*	6,641	115,774	17.43	48	44,428	992,303	20.80
				49	24,801	640,374	25.85
				1950	48,193	1,281,000	26.58

*Figures since 1924 include mica recovered from kaolin, as a by-product, and from mica schists.

However, this source was cut off in 1945 when the program was terminated. Much of the production since that time has been from primary scrap mica deposits. In 1951 the United States Government initiated its Defense Minerals Exploration Administration which has aided in the production of sheet mica. Production has not as yet provided sufficient by-product scrap to influence the scrap supply appreciably. The Spruce Pine district accounts for approximately 75 percent of the State's production of scrap mica.

The status of North Carolina as a major producer of scrap mica is shown in Table V. As indicated, North Carolina produced 65 percent of the raw scrap consumed in the United States during the period 1940-1949. More significant, however, is that with increased production throughout other sections of the United States, North Carolina produced 55.6 percent of the total domestic supply for the 1940-1945 period and increased this to 77.4 percent for the 1945-1950 period. The ability not only to reach this status but to maintain it is an indication of the future possibilities of the scrap mica industry of North Carolina.

TABLE V. COMPARISON OF VOLUME OF SCRAP MICA SOLD OR USED BY PRODUCERS IN NORTH CAROLINA AND THE UNITED STATES

Year	*United States* (Short Tons)	*North Carolina* (Short Tons)	*N. C. Production* % Total
1940	22,386	11,595	51.8
1941	32,500	18,234	56.1
1942	43,262	24,145	57.7
1943	46,136	25,295	54.8
1944	51,727	29,774	57.6
1945	41,060	30,682	74.7
1946	53,602	39,100	73.9
1947	49,797	38,655	77.6
1948	52,157	44,428	85.2
1949	32,856	24,801	75.5

OCCURRENCE OF SCRAP MICA IN NORTH CAROLINA

Mica is a common constituent of many metamorphic and igneous rocks, but its occurrence in quantities and qualities of economic significance is limited. In North Carolina those occurrences that are sources or potential sources of scrap mica may be classed into four general groups: (1) as small flakes in lenses of very high-grade muscovite mica schist, (2) as small flakes and books in some granites, (3) as small to medium flakes and books in alaskite, and (4) as small to large flakes and books in pegmatites. Of these the latter two are by far the most important and constitute most of the proven reserves.

In some areas of North Carolina, especially in the Spruce Pine district, small lenses of high-grade mica schist occur in which the muscovite content is 90 percent or more. Individual flakes are generally small and crenulated, making fine-grinding of the material rather difficult. Attempts have been made to mine and process mica schist in North Carolina, but these attempts have been unsuccessful. Such occurrences do not appear to be of particular value to the scrap mica industry in the immediate future.

Most granites have too low a muscovite content and contain too many iron-bearing minerals to be suitable sources of scrap mica, although they constitute tremendous reserves of material. Biotite, usually quite prevalent, is especially harmful since it cannot be separated economically from the muscovite. In some instances, however, considerable concentrations of muscovite mica and feldspar occur along the border and internal fracture zones of granite bodies and adjacent to mica schist inclusions and wall rock. Such concentrations have been formed largely by pegmatitic action, by assimilation of parts of the country rock by the granite, or by a combination of pegmatitic activity and assimilation. Granite has limited potentialities as a source for scrap mica if it has been sufficiently enriched. That occurring in the Kings Mountain area appears to offer the best possibilities.

The alaskite formations of the Spruce Pine district represent the greatest reserves of scrap mica in the State. Muscovite mica occurs throughout the rock, often making up from 10 to 20 percent of the total weight.

Biotite and other iron-bearing minerals are usually present in very small quantities, being more prevalent along the border phases. The great volume and relative uniformity of alaskite make it a highly valuable rock to the scrap mica, feldspar, and kaolin industries. In its unweathered state, alaskite is mined and processed for feldspar, scrap mica being recovered as a by-product. In deeply weathered parts of the formation in which the iron-bearing minerals are negligible, the rock is mined for its kaolin content, and scrap mica is recovered during processing. Those highly weathered zones richest in muscovite mica are mined directly for scrap.

Mica occurring in pegmatites is usually much larger and of a higher quality than that occurring elsewhere. Most mica mining in pegmatites is carried out primarily for sheet, scrap being saved where possible. In some of the larger pegmatites, mining may be for the high quality scrap, and sheet is recovered during mining and concentration. Scrap obtained from pegmatites is usually most desirable for wet grinding. However many pegmatites containing high contents of excellent muscovite are too small to be worked profitably. The scrap mica deposits in pegmatites are, therefore, limited to the larger bodies which contain in excess of about 8 percent recoverable mica and which are sufficiently weathered to allow easy mining. Although pegmatites are mined for scrap in all districts, usually in conjunction with granite and alaskite, only in the Franklin-Sylva district do large individual bodies constitute the bulk of the scrap mica reserves.

RESERVES

An estimate of scrap mica reserves is at best highly speculative since there are many uncontrollable economic and geologic variables to be considered. The present investigation was confined to the more outstanding primary scrap mica deposits, and reserve figures apply only to these sources.

It is estimated that the primary scrap deposits contain a minimum of 31,000,000 tons of ore averaging from 12 to 18 percent mica. Of this amount approximately 25,000,000 tons are in the Spruce Pine district and are present as indicated in the following breakdown:

Plus 8 mesh Mica

In excess of 6%	1,500,000 Tons
Between 5 and 6%	1,200,000 Tons

Total Mica Content

Ore containing between 12 and 15 per cent mica	15,000,000 Tons
Ore containing between 15 and 18 per cent mica	10,000,000 Tons

This does not include that mica in the many sub-marginal deposits, in the large kaolin deposits, nor the potential to be derived from feldspar and sheet mica mining and processing. Hunter estimates the kaolin deposits to contain approximately 51,000,000 tons of kaolin. Many of these deposits, although fine grained, contain from 12 to 18 percent mica.

The Shelby district has not been prospected thoroughly but is estimated to contain a minimum of 5,000,000 tons of mineable ore. Reserves in the Franklin-Sylva district are confined to a few large pegmatites which are estimated to contain in excess of 1,000,000 tons of high-grade ore.

These figures are conservative and are expected to be revised upward as more thorough prospecting is carried out or if the lower-grade deposits now considered as sub-marginal are worked in the future. The amount of material containing in excess of 5 percent plus 8 mesh mica is quite limited.

FUTURE OUTLOOK

The reserves of scrap mica in North Carolina appear sufficient to back the expanding scrap mica industry for a considerable period of time. However, the ore containing sizeable percentages of plus 8 mesh mica is definitely limited, and may well be depleted within the foreseeable future. There are large reserves of material containing from 12 to 18 percent mica, most of which is fine. Future production, therefore, will depend largely upon industrial demand. Presinet indications are that this demand will continue to increase, and that producers will be forced to recover the fine mica to supply the market.

Although a considerable amount of high quality mica will continue to be mined from pegmatites and coarse alaskite deposits, the principal production in the future will likely be from the large deposits of fine-grained material. The mica smaller than ⅛ inch must be recovered if these bodies are to be economically profitable. Many of the present producers could recover up to twice their normal production by recovery of the fines. However, this does not appear possible in the conventional washer plant.

The trend toward the use of the Humphrey Spirals method of concentration is expected to continue, although a considerable initial cost is involved which makes the process prohibitive in the case of small operations.

PRINCIPAL PRODUCING AREAS

All scrap produced from primary scrap mica deposits in North Carolina comes from three major districts located in the western third of the State. These are the Spruce Pine, Franklin-Sylva, and Shelby. There are other small areas from which some scrap may be produced, but these have not been investigated thoroughly, and therefore are only briefly discussed.

SPRUCE PINE DISTRICT

The Spruce Pine district is an irregular shaped northeastward-trending area approximately 9 miles wide and 18 miles long, which covers parts of Yancey, Mitchell, and Avery Counties. It is located in the Mountain province of the State, approximately 35 miles northeast of Asheville. The district is the leading producer of primary kaolin, feldspar, sheet mica, and scrap mica in North Carolina. Its known reserves of scrap mica exceed by far the combined known reserves of other districts throughout the State. Although

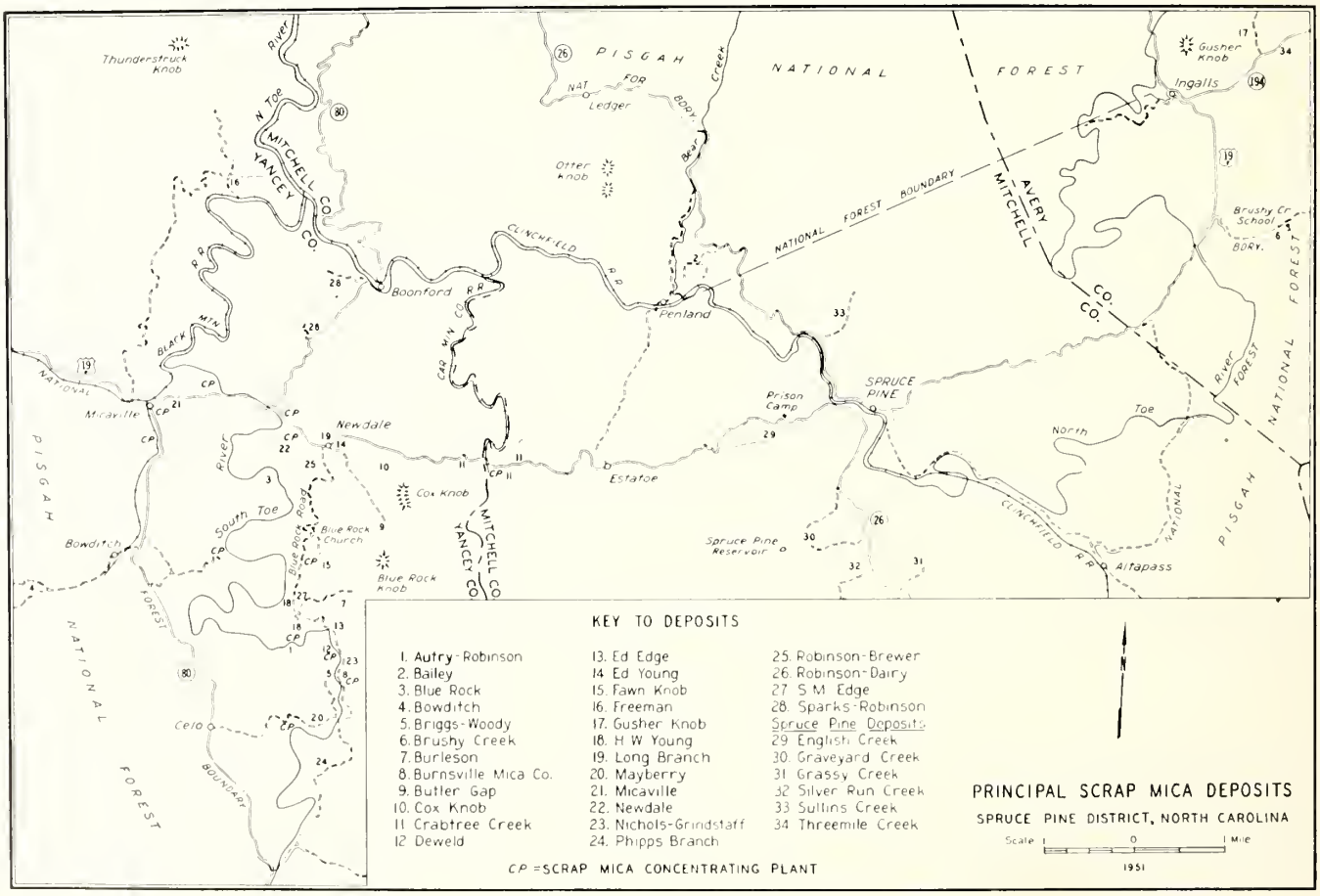


FIGURE 5. LOCATION MAP—SPRUCE PINE DISTRICT

the quality of "alaskite mica" is not in every case as high as that from other sources, its great quantity makes it the mainstay of the scrap mica industry. The Spruce Pine district produces over 75 percent of all scrap mined in North Carolina.

GEOLOGIC SETTING

Scrap mica deposits of the Spruce Pine district consist of mica-rich portions of deeply kaolinized alaskite. This rock type underlies a large part of the district and is exposed as a series of irregular bodies which are, in places, as much as two miles wide and over two and one-half miles long. These bodies intrude a series of highly contorted gneisses and schists and both are intruded by pegmatites. In most cases the alaskites are conformable with the regional northeasterly strike and southeasterly dip of the gneiss-schist series. The largest bodies are in the vicinity of Spruce Pine, and they become smaller toward the northeast and southwest.

Exposures indicate that the deposits have very irregular contacts which, in some instances, are clearly defined, and in others, appear to grade into the surrounding rock formation. Although contacts or "walls" may roll locally, most are very steep. Inclusions, principally mica and hornblende schists, are present in varying proportions and sizes throughout most alaskite bodies.

Pegmatites are common in the alaskite, especially in the more highly fractured areas. Solutions forming the pegmatites also permeated the adjacent rock, resulting in zones of coarse material. These zones are important in economic development of the alaskite.

Although there is an overall uniformity of mineral content and texture in the alaskite formations, locally wide differences occur. The scrap deposits are composed for the most part of mica, kaolin, and quartz. Biotite and garnet, usually present in small amounts, increase near hornblendic inclusions and the wall rock. In the vicinity of some mica-schist inclusions, the muscovite size and content increase. This is also true where pegmatitic materials have invaded the alaskite.

Most of the deposits in the immediate vicinity of and toward the northeast from Spruce Pine are relatively fine grained. The residual kaolin deposits in this part of the district seldom contain over 3 or 4 percent of plus 8 mesh mica. Toward the southwest, especially in the Micaville-Celo area, the rock is coarser and many deposits contain from 5 to 7 or more percent of plus 8 mesh mica. However, within this area the content of coarse mica varies considerably between adjacent deposits.

In general the larger deposits are finer grained, and those in excess of 200 feet wide seldom contain enough coarse mica to be recovered profitably by the conventional washer plant now operating in the district. However, those deposits which have been subjected to later magmatic solutions contain zones of coarser materials in which the mica is recoverable.

The workable depth of a deposit is often controlled by the depth of weathering. Those areas most suitable for scrap mica mining are confined to the more highly kaolinized coarse phases of the alaskite, usually occurring along the lower ridges. In many parts of the district these ridges represent old stream terrace levels, and are capped with unsorted sand, silt, and gravel. These caps have retarded erosion and, by furnishing large amounts of ground water over long periods of time, accelerated the rate of weathering of the underlying rocks. Where alaskite bodies underlie such terraces, they are usually well kaolinized and are, therefore, the most desirable for scrap mica deposits.

Many alaskite bodies are deeply weathered to more than 100 feet, while others are relatively fresh at or near the surface. Such conditions are apparently controlled for the most part by a deposit's topographic position and the accessibility of the rock to the weathering and erosive agencies. Many deposits located along the crests or sides of hills having gentle slopes and those near the crests of some of the steeper hills are weathered relatively deep. Those along the sides of steep ridges and in valleys close to local drainage levels are seldom weathered to appreciable depths. Bottom limits of soft material are quite erratic within individual deposits and appear related to fracture systems within the alaskite mass. The more schistose zones in the alaskites offer easy access to percolating waters and are usually more deeply weathered than the massive zones.

Overburden may be as thick as 25 feet locally, but in most cases it is less than 5 feet. The thick overburden is often composed of old stream terrace material or talus but is seldom present in such quantities as to affect mining seriously.

DESCRIPTION OF DEPOSITS

AUTRY-ROBINSON DEPOSIT

The deposit is on the property of the heirs of John H. Robinson in eastern Yancey County, 1.3 miles N43°E of Celo. (Figure 5, Location 1). It is located on the north side of Bailey Mountain, south of the South Toe River. At present it is not accessible by road. Numerous small sheet mica mine and prospect pits have been dug in and near the deposit.

Pegmatites and narrow bands of alaskite occur in Shanty Ridge and in the ridge to the east. The alaskite is narrow, having a maximum width of 25 to 30 feet. Most of the material contains a high percent of plus 8 mesh mica, averaging 5 percent or more.

There does not appear to be sufficient reserves of ore in the deposits to justify the erection of a concentrating plant. The ore could be hauled by trucks to a nearby plant.

BAILEY SCRAP MICA DEPOSIT

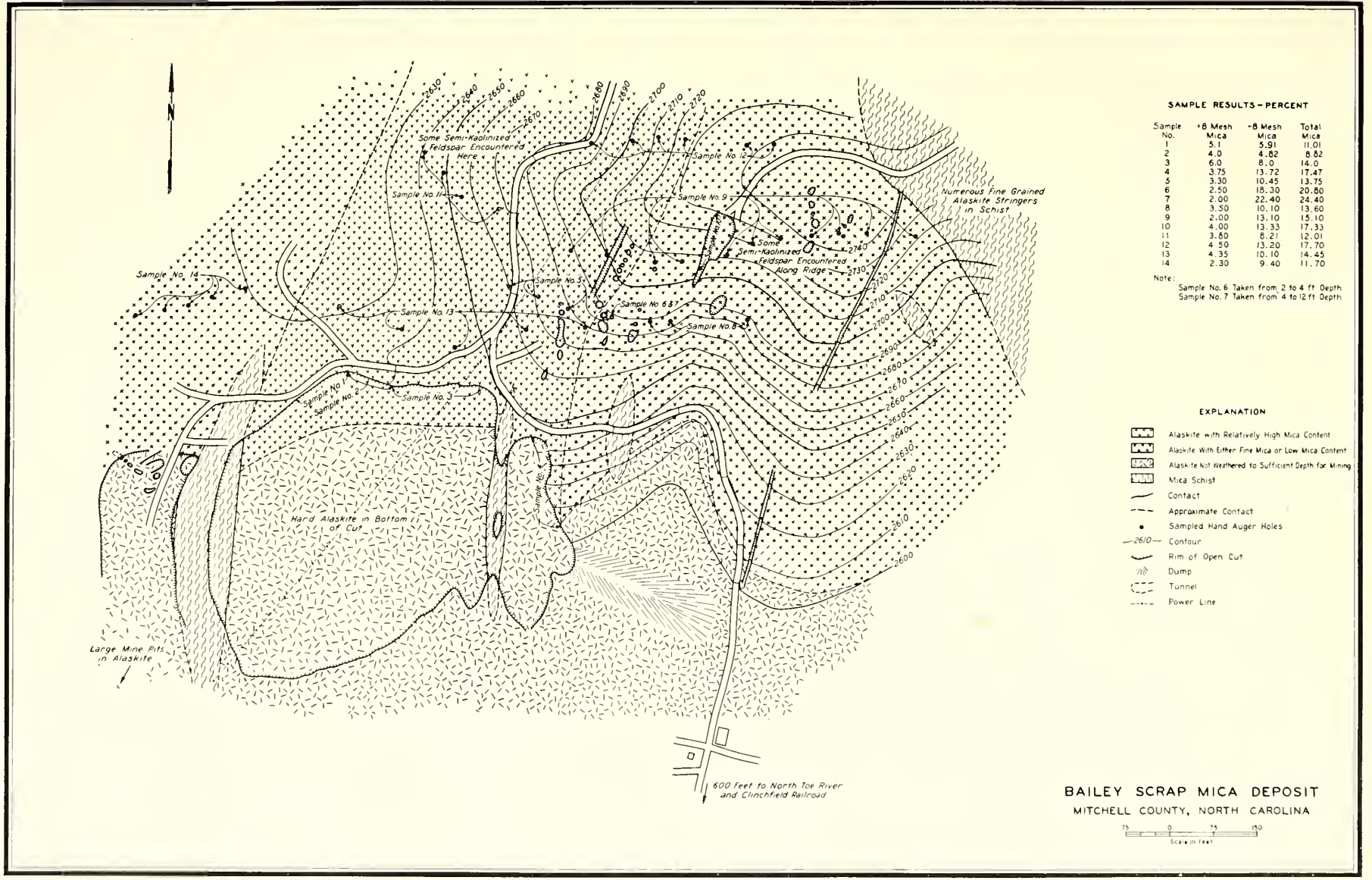
The Bailey Scrap Mica deposit is located in southern Mitchell County, 2.5 miles N55°W of Spruce Pine and 0.6 of a mile N38°E from Penland. (Figure 5, Location 2). It can be reached by following U. S. Highway No. 26 northwestward from Spruce Pine to a point 0.4 of a mile west of Little Bear Creek and taking the old mine road for 0.4 of a mile south. The deposit is located on the property of Harry Bailey, Jr., of Penland. Kaolin has been produced from this deposit intermittently since about 1905 by Harris Clay Company and Carolina China Clay Company, the latter suspending operations about 10 years ago. The property was not being worked as late as 1952.

Present workings consist of six large pits and many smaller mines and prospects. The principal pit shown on Plate 1 is approximately 500 feet in diameter and, in places, more than 60 feet deep. Others not shown on the map are located 300 feet to the southwest and 1200 feet to the east. Numerous mine and prospect pits occur along the ridge above the old road. Sheet mica and feldspar have been produced from pegmatites near the contacts and within the alaskite body. An example of such an occurrence is in the Deer Park Feldspar mine south of the river.

The country rock is principally mica schist, but narrow zones of hornblende gneiss are present in inclusions and along the contacts. In some areas, especially along the eastern contact, the alaskite grades into the schist. This resulted from impregnating granitic solutions altering and apparently dissolving some of the schist. Numerous alaskite pods and stringers were also intruded into the schist, and in some places make up 30 to 40 percent of it. The country rock, observed in inclusions and along the western contact, strikes from due north to N10°E. Along the eastern contact of the area, shown on Plate 1, it strikes from N25°W to N35°W. Inclusions observed in cuts are folded but in general dip from 70 to 80 degrees to the east.

The alaskite body is 2000 feet wide near the North Toe River and increases to over 3000 feet near Highway 26. A large inclusion occurs near the center of the deposit. East of the main cut this inclusion has a width of from 300 to 500 feet and is about 1200 feet wide near the highway. Other inclusions found throughout the alaskite body vary from a few feet to several hundred feet across. However, zones of alaskite up to 400 feet wide occur without inclusions. Most inclusions are so small in comparison to the size of the alaskite that they should not interfere with mining. All detail investigation was done west of the inclusion, shown as the eastern contact of the alaskite body on Plate 1. This section is over 1500 feet wide at the north end of the cut and extends some distance farther to the west than is shown on Plate 1. It was drilled over a distance of 400 feet north of the cut, and indications are that similar material occurs for several hundred feet north of this point. Sufficient work was not done to estimate the size and percent of mica throughout the entire deposit.

The alaskite is finer grained than most deposits being worked for scrap mica but is unusually coarse grained for a body of this size. The coarser material occurs in the north face of the open cut and extends in a northeasterly direction. This zone, from 300 to 350 feet wide, contains an average of from 4 to 5 percent plus 8 mesh mica with higher concentrations locally. The alaskite, both to the east and west, is finer



BULLETIN 66—PLATE 1

grained, averaging from 2 to 3 percent plus 8 mesh mica but containing some coarser material in narrow zones. A trench sample from the open cut on the hill contained 4 percent plus 8 mesh mica.

The great value of this deposit lies in its size and total mica content. The mica content of fourteen samples varied from 8.82 to 24.4 percent, averaging 15.15 percent. This is slightly over four times the average percent of plus 8 mesh mica in the ore. The alaskite on the hill northeast of the large cut contains even a higher proportion of fine mica. In the areas sampled, the mica was of a high quality.

It is difficult to estimate the depth of weathering in some areas of the deposit. In the large cut relatively soft material occurs to a depth of about 60 feet in places, but hard alaskite was encountered at a much shallower depth on the southern end. Indications are that hard rock will be reached at a shallow depth between the cut and the river. The alaskite is apparently weathered to a depth of from 40 to 60 feet northeast of the open cut. Semi-kaolinized feldspar was encountered at some places on the hill northeast of the open cut. It is estimated that the average depth of weathering on the hill is from 30 to 40 feet. Hard rock was encountered in drill holes at numerous places along the ridge southeast of the large cut and east of the old road.

The production possibilities of this deposit are as good as that for any deposit examined. A power line extends across the deposit, and the North Toe River and the Clinchfield Railroad are approximately 650 feet south of the large cut. Most of the material could be mined hydraulically and washed to a plant at the railroad with a minimum amount of excavation. The large quantity of material obtainable would enable a relatively permanent operation. However, the economic development of this deposit would necessitate the recovery of fine mica. There is also a possibility that considerable kaolin might be produced.

Of the part of the property examined in detail and shown on Plate 1, reserves are estimated to be from 600,000 to 850,000 tons of material averaging above 4 percent plus 8 mesh mica and from 1,000,000 to 1,500,000 tons of material containing a total mica content of approximately 15 percent. It is estimated that the entire deposit contains between 3,000,000 and 4,000,000 tons of ore.

Sample Results—(See Plate 1 for results on samples 1 through 14) :

Sample No.	*Plus 8 Mesh Mica*	*Minus 8 Mesh Mica*	*Total Mica*
15	4.8%	12.1%	16.9%
16	5.4	15.0	20.4
17	2.7	13.2	15.9

Sample No. 15. A trench sample from the large open cut on the ridge west of Little Bear Creek.

Sample No. 16. A trench sample from the smaller open cut on the ridge west of Little Bear Creek.

Sample No. 17. A trench sample taken over a distance of approximately 100 feet along the road bank of Highway 26. It was obtained west of the crest of the ridge at the small tunnel.

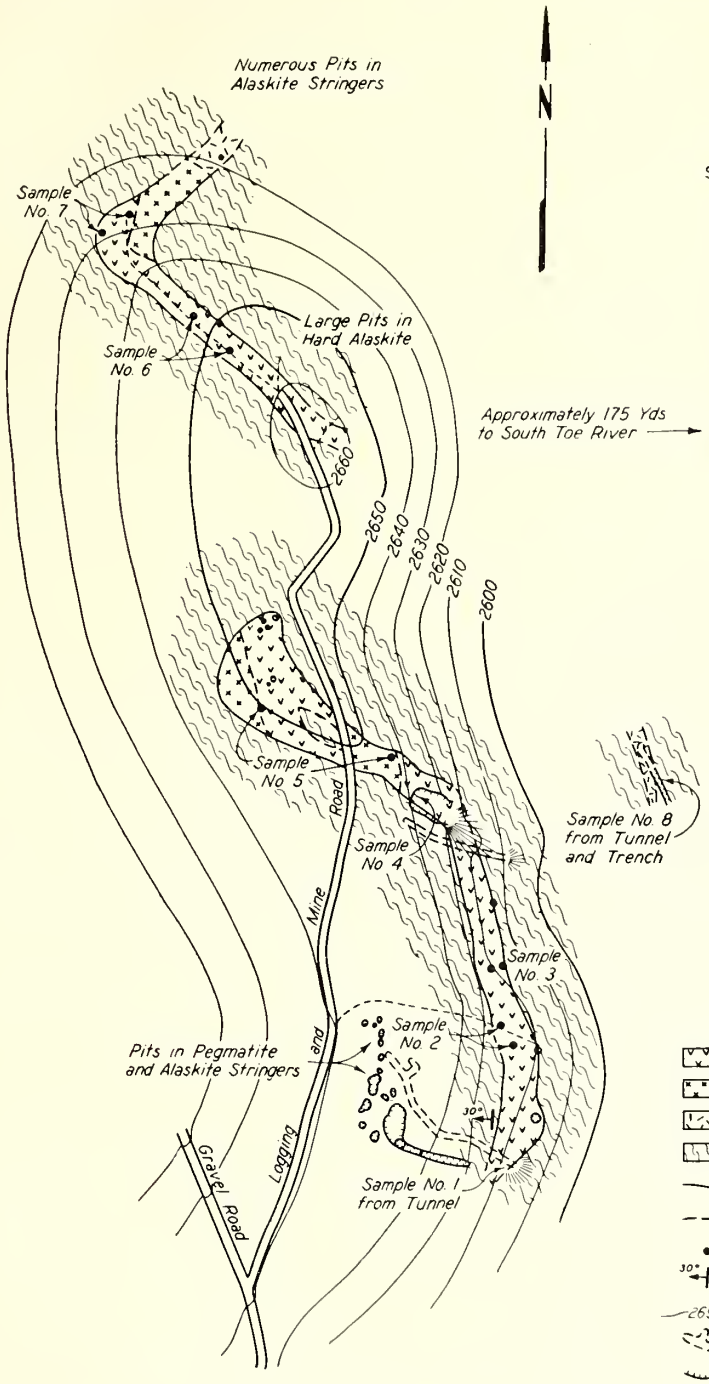
BLUE ROCK DEPOSIT

The deposit is located in eastern Yancey County 1.6 miles S60°E of Micaville. It is on the west side of the South Toe River and can be reached by following the Blue Rock Road to the Blue Rock Church, turning west on the old road and following it for about 0.75 of a mile west of the river. It is accessible by the Rice Road south from Highway No. 19E. The property is reportedly owned by the Newdale Mica Company, Kona, North Carolina. (Figure 5, Location 3).

Numerous pits and tunnels, made while prospecting for sheet mica, are found in the deposit and in the several adjacent pegmatites. The southern alaskite body is well exposed in two tunnels which traverse it. Most of the old workings are confined to the small pegmatites.

The country rock is mica schist which has a geneeral strike of from N10°W to N40°W, but owing to some large folds, it strikes in places to the northeast. The schist observed in tunnels dips approximately 30 degrees to the southwest. Much of the schist has been impregnated with granitic solutions and consequently contains many small stringers and pods of alaskite.

The deposit consists of several relatively narrow alaskite bodies, the two largest of which are shown on Plate 2. The maximum width of the bodies is about 60 feet, the average width being between 20 and 30



SAMPLE RESULTS – PERCENT

Sample No.	+8 Mesh Mica	-8 Mesh Mica	Total Mica
1	8.0	12.37	20.37
2	7.15	12.08	19.23
3	13.34	10.61	23.95
4	16.04	15.66	31.70
5	4.9	14.4	19.3
6	9.9	12.5	22.4
7	4.8	18.8	23.6
8	13.3	10.6	23.9

EXPLANATION

- Alaskite With Relatively High Mica Content
- Alaskite With Either Fine Mica or Low Mica Content
- Alaskite Not Weathered to Sufficient Depth for Mining
- Mica Schist
- Contact
- Approximate Contact
- Sampled Hand Auger Holes
- 30° Strike and Dip of Formation
- 2690 Contour
- Tunnel
- Rim of Open Cut
- Dump
- Trail

BLUE ROCK SCRAP MICA DEPOSIT

YANCEY COUNTY, NORTH CAROLINA

75 0 75 150
Scale in Feet

BULLETIN 66—PLATE 2

feet. The largest body has a length of approximately 500 feet. Numerous small deposits occur in the area, especially to the east and northeast of the ones shown on Plate 2. Most of these are rather well exposed in old workings, are relatively narrow, and contain varying quantities of hard rock. Indications are that inclusions make up at least 10 percent of the deposit.

The deposit, in general, contains a high percent of plus 8 mesh mica, but there are zones of fine-grained material. The plus 8 mesh mica content of the eight samples taken varied from 4.8 to 16.34 percent with an average of 9.67 percent. The total mica content varied from 19.23 to 31.70 percent, averaging 23.05 percent. None of these samples are representative of the fine-grained material shown on Plate 2. Some biotite was observed, especially near the contacts and inclusions.

Indications are that the depth of weathering varies considerably for different parts of the deposit. Near the crest of the hill the rock is probably weathered to 30 or 35 feet, but hard rock will be encountered at a shallower depth along the slopes and may vary from a few feet to 25 or 30 feet.

The individual deposits, although containing a high percent of plus 8 mesh mica, are relatively narrow. There does not appear to be sufficient ore to justify the erection of a scrap mica concentrating plant unless additional supplies of ore are found in the vicinity.

Assuming an average depth of weathering of 25 feet it is estimated the deposit contains from 30,000 to 40,000 tons of ore.

Sample results are given on Plate 2.

BOWDITCH DEPOSIT

This location is in eastern Yancey County, one mile S72°W of Bowditch, on the property of Blue Ridge Mining Company of Burnsville, North Carolina. (Figure 5, Location 4). Two small prospect pits on the northwest side of the deposit are the only workings at present. The country rock is hornblende gneiss, the foliation of which strikes N30°E and dips from 40 to 50 degrees to the northwest.

The deposits consists of a lens-shaped pegmatite approximately 175 feet long and from 50 to 55 feet wide near the center section. The width decreases rather uniformly from the center toward both ends. One inclusion, approximately 5 feet wide, occurs near the center of the deposit. Other smaller inclusions probably exist.

The material ranges in mica content from 10 to 15 percent, of which about 5 percent is larger than 8 mesh. Some mica books up to 2 inches across were encountered in drilling and indications are that a considerable amount of punch and some sheet mica might be present.

Weathering probably extends to a depth of 25 to 30 feet.

The reserves are estimated to be from 12,000 to 15,000 tons of ore.

Sample Results:

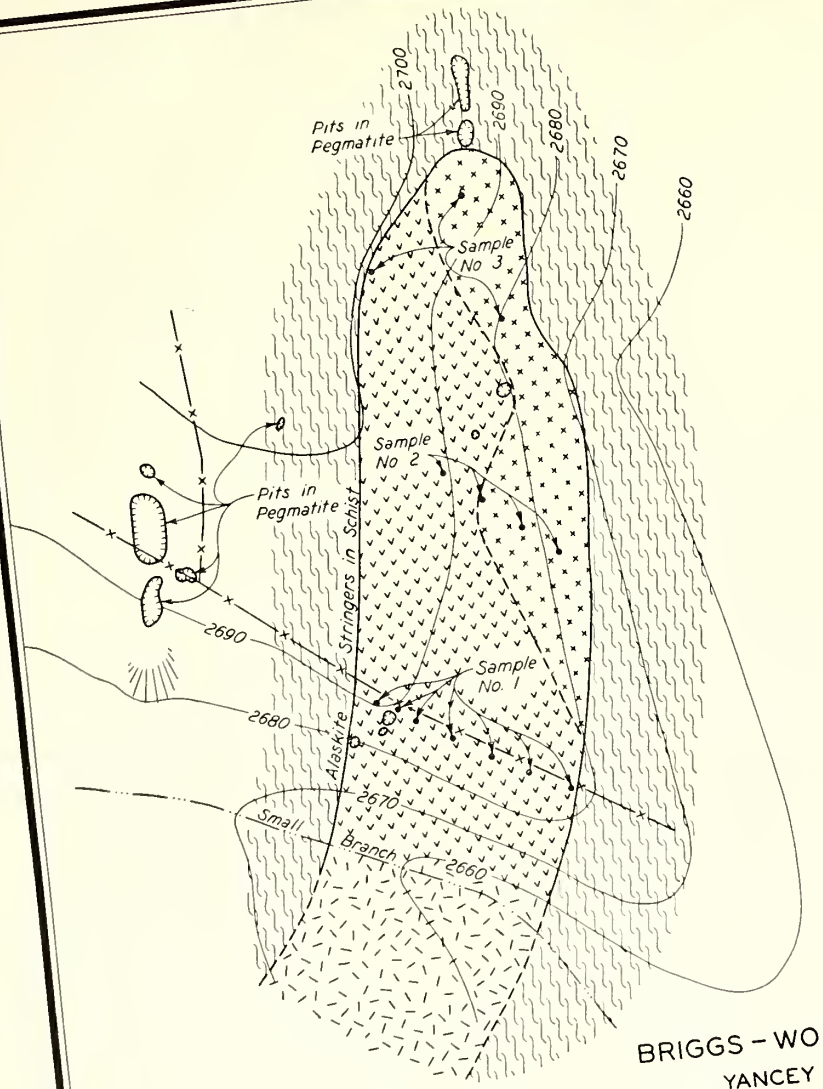
Sample No.	*Plus 8 Mesh Mica*	*Minus 8 Mesh Mica*	*Total Mica*
1	5.1%	9.9%	15.0%
2	1.6	6.97	8.57

Sample No. 1. A composite sample from four hand auger holes taken across the strike of the deposit.

Sample No. 2. A composite sample of five hand auger holes taken near the contacts on both sides of the deposit.

BRIGGS-WOODY DEPOSIT

The deposit is located in the eastern part of Yancey County, 1.5 miles N60°E of Celo and approximately 700 feet west of the South Toe River. (Figure 5, Location 5). The best route to the deposit is along the Browns Creek Road eastward from Celo to the South Toe River and from this point along the west side of the river for 0.6 of a mile. The deposit is located about 300 feet northwest of an old barn. In 1950 mineral rights were owned by Green Woody, Burnsville, North Carolina, and Clarence Briggs, Alexandria, Virginia.



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SAMPLE RESULTS – PERCENT

Sample No.	+8 Mesh Mica	-8 Mesh Mica	Total Mica
1	6 0	16. 22	22.22
2	2. 1	7 79	9 89
3	1 7	6 8	8.5

EXPLANATION

- Alaskite With Relatively High Mica Content
- Alaskite With Either Fine Mica or Low Mica Content
- Alaskite not Weathered to Sufficient Depth for Mining
- Mica Schist
- Contact
- Approximate Contact
- Sampled Hand Auger Holes
- 2680 — Contour
- Rim of Open Cut
- Dump
- —x— Fence

BRIGGS – WOODY SCRAP MICA DEPOSIT

YANCEY COUNTY, NORTH CAROLINA

45 0 45 90

Scale in Feet

Present workings consist of a few small prospect pits which are seldom over three feet deep and some larger pits in pegmatites west and north of the alaskite body. The country rock is mica schist which strikes approximately N10°E and dips steeply to the northwest. Many small pegmatites occur in the schist near the alaskite body, some of which have been prospected for sheet mica.

The deposit is from 110 to 120 feet wide and approximately 400 feet long. It strikes N10°E, roughly paralleling the foliation of the country rock. The area southwest of the small branch is covered with clay and loose rock overburden, and some exploration work will be necessary to determine if scrap mica underlies it. Indications are that the deposit does extend southwest of the branch, and that this extension may be rather large. No inclusions were observed in the deposit.

Much of the deposit is relatively coarse grained, containing around 5 percent plus 8 mesh mica. A zone along the northeast contact (see Plate 3) is composed of fine-grained alaskite, which averages about 2 percent plus 8 mesh mica. The highest percentage of coarse mica encountered was near the fence on top of the small ridge. A composite sample from seven hand auger holes taken at this locality contained 6.0 percent plus 8 mesh mica. Most of the material is progressively finer grained northeast of this point. Practically no biotite was encountered.

The alaskite north of the branch is believed to be weathered to a depth of 30 to 35 feet. Along the branch and to the southwest indications are that hard rock will be encountered at a much shallower depth.

The deposit is believed to have good production possibilities, especially if it is found to contain a sizeable amount of ore southwest of the branch. There does not appear to be sufficient material north of the branch to justify the erection of a plant, although mica could be mined along with some other deposits in the area and washed or hauled to a central plant.

With a small amount of bulldozer work, the material can be mined hydraulically and washed to a number of different locations along the South Toe River, however, additional reserves should be considered in selecting a plant location.

It is estimated that the deposit shown on Plate 3 contains 90,000 tons of ore. Material south of the branch should increase the reserves a substantial amount.

Sample results are given on Plate 3.

BRUSHY CREEK DEPOSIT

This deposit, located in the southwest part of Avery County 4.5 miles N60°E of Spruce Pine, (Figure 5, Location 6) has been mined for kaolin by the Harris Clay Company for several years. Scrap mica is a by-product. The deposit was first worked for kaolin by Kaolin, Incorporated, about 1937.

A large area adjacent to Brushy Creek is underlain by weathered alaskite. The material is fine grained, and the mica content is variable. Most of the alaskite apparently contains a total mica content of between 10 and 15 percent.

The deposit was not examined in detail and no samples were taken.

BURLESON DEPOSIT

A relatively large alaskite body is located in eastern Yancey County, 3.2 miles S50°E of Micaville on a ridge 0.4 of a mile S45°E of Fawn Mountain. There are no accessible roads to the deposit. The property is owned by Milton Burleson, Spruce Pine, North Carolina. (See Figure 5, Location 7).

The alaskite, as exposed by numerous pits, tunnels, and shafts along the crest and southeast side of the ridge, appears to be at least 200 feet wide. It strikes northeast across the ridge.

The deposit is relatively fine grained. The four samples taken varied from 2.36 to 5.2 percent plus 8 mesh mica with an average of 3.29 percent. The average total mica content is approximately 18.00 percent.

The material along the crest of the ridge appears to be weathered to a depth of 30 or 35 feet, although hard rock will be encountered at a shallow depth on both sides of the ridge.

Sample Results:

Sample No.	*Plus 8 Mesh Mica*	*Minus 8 Mesh Mica*	*Total Mica*
1	3.20%	12.95%	16.15%
2	2.40	14.80	17.20
3	2.36	15.30	17.66
4	5.20	15.60	20.80

Sample No. 1. Trench sample taken from a tunnel on the side of the ridge and from a mine pit above the tunnel.

Sample No. 2. Composite sample from five hand auger holes and one mine pit along the ridge above the tunnel.

Sample No. 3. Composite sample from four hand auger holes and one mine pit near the crest of the ridge.

Sample No. 4. Composite sample from four mine pits and one tunnel near the crest of the ridge north of the location of Sample No. 1.

BURNSVILLE MICA COMPANY DEPOSIT

The deposit is located in the eastern part of Yancey County 1.5 miles N65°E of Celo, on the east side of the Blue Rock Road. (Figure 5, Location 8). The mineral rights are owned or leased by the Burnsville Mica Company, Burnsville, North Carolina.

In 1950 this company erected a scrap mica concentrating plant on the deposit and has been producing scrap mica from it since then. The ore is broken up either by blasting or with a bulldozer and washed to the plant.

A large body occurs east of the plant and extends a considerable distance eastward, although all of the deposit was not examined in detail. The main body is relatively fine grained, but local zones in it and numerous smaller bodies found near it contain a high percent of plus 8 mesh mica. Of the four samples taken the plus 8 mesh mica content averaged 7.0 percent, but this is not representative of the finer material which makes up the main body. The total mica content of the samples averaged 18.69 percent.

Numerous schist inclusions occur throughout the deposit, some of which are exposed in the open cut. They appear to be much more numerous near the contacts.

Some semi-kaolinized feldspar was encountered and it is likely that the depth of weathering varies for different areas of the deposit. Most of the material appears to be weathered to a sufficient depth for mining but some bulldozer work or light blasting may be necessary to break it up.

Sample Results:

Sample No.	*Plus 8 Mesh Mica*	*Minus 8 Mesh Mica*	*Total Mica*
1	7.2%	15.32%	22.52%
2	6.8	8.95	15.75
3	5.6	12.30	17.90
4	8.7	9.91	18.61

Sample No. 1. Composite sample from three hand auger holes taken approximately 100 feet apart from 160 to 360 feet east of the open cut.

Sample No. 2. Composite sample from five hand auger holes taken approximately 80 feet apart from 20 to 340 feet southeast of the open cut.

Sample No. 3. Composite sample from one hand auger hole and the bulldozer cut located about 50 feet southeast of the open cut.

Sample No. 4. A sample from the open cut mine at the plant.

BUTLER GAP DEPOSIT

The deposit is located in the eastern part of Yancey County, 2.9 miles S70°E of Micaville, and can be reached from Highway 19E by following the Ed Young Road 1 mile southeast. (Figure 5, Location 9). In the spring of 1950, the Southeastern Mica Company worked the deposit on a small scale, the ore being hauled by truck to their plant near Crabtree Creek in Mitchell County. No mining was carried out in 1951 or 1952.

The deposit has a maximum width of about 200 feet and a general northeasterly strike. The plus 8 mesh mica content varies considerably for different areas of the deposit. Some sections contain a relatively high percentage. A trench sample taken across the strike of the deposit contained 5 percent plus 8 mesh mica with a total mica content of 16.8 percent.

The depth of weathering of the deposit appears to be irregular. Hard rock will probably be encountered within 25 or 30 feet.

COX KNOB DEPOSIT

Several zones of alaskite, containing high percentages of plus 8 mesh mica, traverse a ridge 0.3 of a mile northwest of Cox Knob in eastern Yancey County. (Figure 5, Location 10). The deposit is 2.7 miles S80°E of Micaville. Contacts of individual alaskite bodies were not determined and, therefore, an estimate of their size or available tonnage cannot be given with any degree of accuracy.

Auger holes were drilled at right angles to strike of the formation for a distance of 225 feet, and a considerable amount of schist was encountered. Indications are that the schist may occur in such quantities as to make mining unprofitable. Where the holes penetrated the alaskite, especially in the western part of the deposit, the plus 8 mesh mica was quite abundant.

Sample Results:

Sample No.	*Plus 8 Mesh Mica*	*Minus 8 Mesh Mica*	*Total Mica*
1	9.5%	6.2%	15.7%

Sample No. 1. A composite sample taken from 7 hand auger holes, representing the quality of the ore only. Quantity was not determined. However, the deposit appears to warrant more exploration.

Narrow bands of alaskite and mica schist occur along the ridge northwest of the above described deposit, on the property of Mills Edge of Newdale, North Carolina. The alaskite is exposed by numerous pits and shafts dug while prospecting for sheet mica. The bands of alaskite are narrow, seldom exceeding 20 feet in width. The mica content of the individual bands varies considerably.

CRABTREE CREEK DEPOSITS

One deposit is located in the southwest part of Mitchell County 0.4 of a mile east of Crabtree Creek on the north side of Highway 19E. (Figure 5, Location 11). The mineral rights on the property belong to Harris Clay Company, Spruce Pine, North Carolina.

Both kaolin and scrap mica have been produced from the weathered alaskite body. Kaolin was mined from the two large pits near the crest of the small ridge by Harris Clay Company, and the Southern Mica Company produced scrap mica from the smaller pit adjacent to the road.

The deposit consists of a series of lens-shaped alaskite bodies which vary from a few feet to about 200 feet in width. The general strike ranges from due north to N45°E. However, the alaskite was intruded into folds in the mica schist and hornblende gneiss and therefore has a northwest strike locally. Most of the bodies have irregular contacts due to the folding of the country rock. The principal deposit is near the crest of the small ridge in which the largest pit occurs. Westward from this body, the alaskite becomes narrowed.

The major portion of weathered alaskite has been mined. The largest remaining deposit appears to be on the northeast side of the large open cut. A northeasterly striking alaskite body, approximately 150 feet wide, is exposed in the side of the cut. The extent of this deposit is not known since much of the area to the northeast is covered with overburden. However, it is believed to extend for 100 feet and possibly a greater distance toward the northeast. Some material could be mined with a power shovel from other zones in this pit and from the two pits to the west.

The alaskite is relatively coarse grained, containing an average plus 8 mesh mica content of between 5 and 5.5 percent. The average total mica content is approximately 15 percent.

Sample Results:

Sample No.	*Plus 8 Mesh Mica*	*Minus 8 Mesh Mica*	*Total Mica*
1	4.5%	11.04%	15.54%
2	6.5	9.25	15.75
3	7.0	10.68	17.68
4	5.1	8.27	13.27
5	4.2	6.8	11.0

Sample No. 1. Trench sample taken from the road bank above the open cut mine that was worked by Southern Mica Company.

Sample No. 2. Trench sample taken from the east side of the long open cut on the crest of the hill.

Sample No. 3. Trench sample taken from the northeast side of the large open cut on top of the hill.

Sample No. 4. Trench sample taken from the southeast side of the large open cut on top of the hill.

Sample No. 5. Composite sample from six hand auger holes taken along the fence northeast of the large open cut. A thorough reconnaissance was not made of this area, and it is probable that other deposits occur in the vicinity.

Two other deposits occur near Crabtree Creek. One is on the side of the hill east of Crabtree Creek and south of Highway 19E, and the other is located .4 of a mile west of Crabtree Creek. The northwest end of the latter deposit traverses Highway 19E. However, the major part of the deposit is southeast of the road. The former deposit is being worked at present by the Southeastern Mica Company.

The deposits consist of a sedies of lens-shaped alaskite bodies, seldom exceeding 50 feet in width and occurring close together. These bodies are separated by narrow zones of schist. In general, the deposits contain a relatively high percent of plus 8 mesh mica. The area southwest of the old workings on the latter deposit is believed worthy of a detailed examination. A thorough investigation was not made of either deposit and samples were not taken.

DEWELD DEPOSITS

The DeWeld Scrap Mica Deposits are in eastern Yancey County, 1.6 miles N55°E of Celo, along the northeast side of Bailey Mountain southwest of the South Toe River. They can be reached by following the Blue Rock Road to near Halls Chapel and crossing the river at the low water bridge. The mineral rights on most of the property are owned or leased by the DeWeld Mica Company.

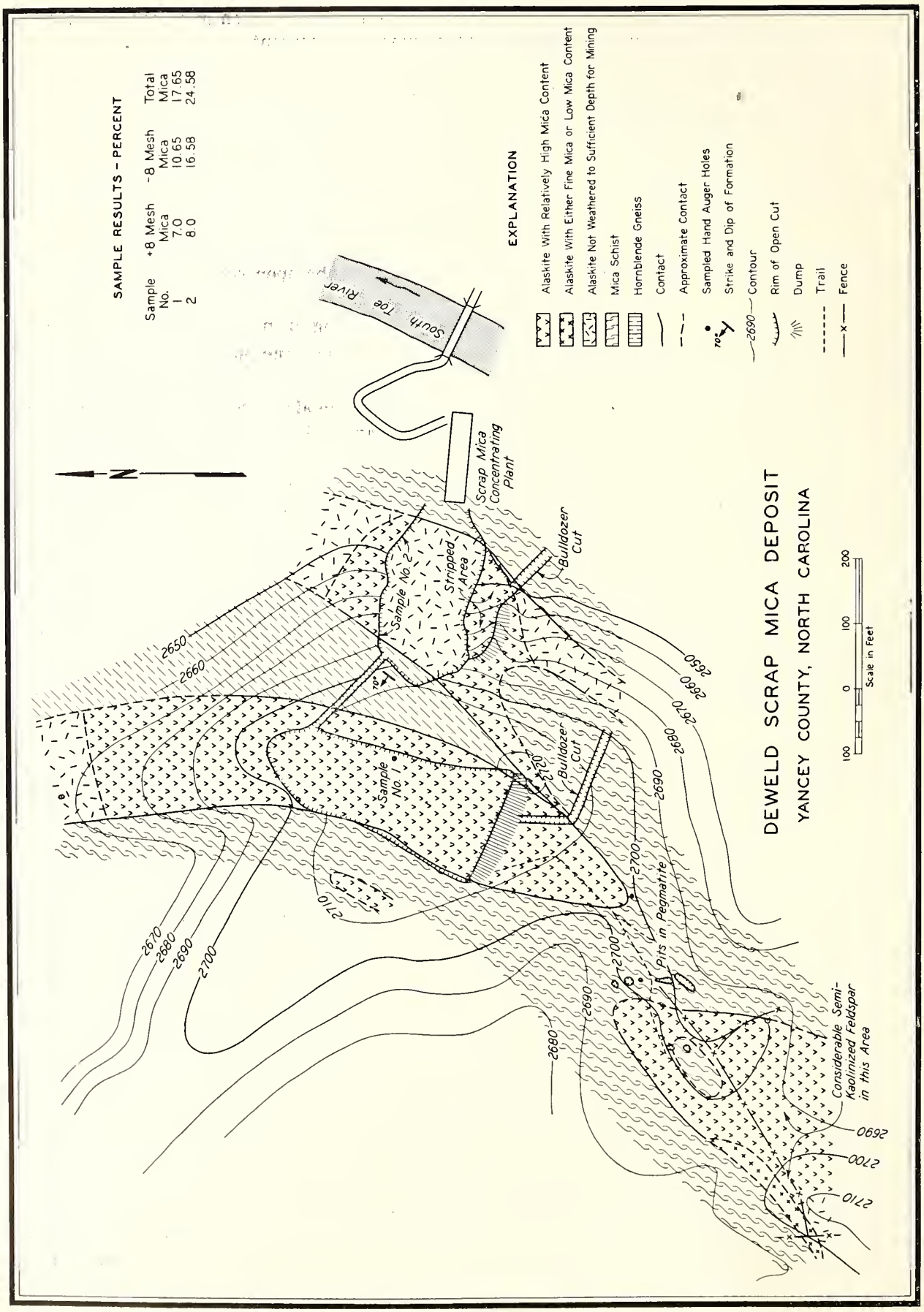
In 1949 the Asheville Mica Company started mining scrap mica from one of the deposits. The ore was mined hydraulically, washed over a mud screen, and hauled by trucks to their plant, about 1.5 miles to the south. In the spring of 1950, the DeWeld Mica Company erected a concentrating plant on the property and has been producing scrap mica since that time.

Hornblende gneiss and mica schist compose the major portion of the country rock. They occur as separate formations and also as narrow interlayered bands. The general strike is from N30°E to N40°E and, where exposed in cuts, the dip is from 60 to 80 degrees toward the northwest.

Three separate alaskite bodies occur in the immediate area. Two are above the concentrating plant and the third, all of which was not mapped in detail, is located on the ridge to the southwest. The bodies are relatively large, varying up to 200 feet in width and more than 800 feet in length (see Plate 4.) Two of the three alaskite bodies are well exposed by open cut mines, but the one to the southwest contains only small prospect pits.

Some inclusions are present but probably do not make up over 5% of the deposits. Most inclusions are small and do not interfere with mining. Indications are that the deposit to the southwest contains larger inclusions than the other two.

The deposits contain a relatively high percent of plus 8 mesh mica, averaging between 6 and 8 percent, and having a total mica content of approximately 20 percent. Since little work was done on the southwestern



BULLETIN 66—PLATE 4

deposit and on the northern part of the deposit on top of the ridge above the plant, an accurate estimate of the mica size and content or the boundaries of the deposits cannot be given. The mica size and content are relatively uniform where exposed in cuts, and it is possible that all of the alaskite shown on Plate 4 contains a high percent of plus 8 mesh mica. Very little biotite is present in alaskite exposed by prospect pits and open cuts.

The depth of weathering varies considerably for different areas, in general being much greater near the crest of the hill. Indications are that hard rock will be encountered at a depth of from 50 to about 80 feet, northeast of the lower cut. Some semi-kaolinized feldspar was observed in the deposits to the southwest, as shown on Plate 4, and it is likely that hard rock will be encountered at a shallow depth in portions of this deposit. The average depth of weathering of all deposits is estimated to be from 30 to 35 feet but should be deeper near the crest of the ridge.

Assuming an average depth of weathering of from 30 to 35 feet the reserves of material shown on Plate 4 are estimated to be as follows: the deposit above the plant, from 40,000 to 55,000 tons, and the deposit on the hill above the plant, from 200,000 to 225,000 tons. Although an accurate estimate cannot be given for the deposit to the southwest, the part shown on Plate 4 is estimated to contain from 60,000 to 75,000 tons. It is highly possible that the tonnage in the latter deposit is much larger. If the deposit on the hill above the plant extends farther to the north than is shown and is weathered to sufficient depth for mining, the reserves in it will be much larger than the figures given above.

Sample results are given on Plate 4.

As stated above, sufficient work has not been done on the southwestern deposit to determine accurately its production possibilities. However, it is suggested that a more detailed examination be made to determine size, texture, and mica content of this body.

ED EDGE DEPOSITS

Several alaskite bodies are on the property of Mr. Ed Edge, Route 2, Burnsville, in the eastern part of Yancey County. This location is 3.3 miles S45°E of Micaville east of the Blue Rock Road. (Figure 5, Location 13).

Several deposits occur in this area but none of them were mapped in detail. In general, they contain relatively high percentages of plus 8 mesh mica, however, the mica content varies considerably among the deposits and within different portions of individual deposits.

Alaskite, exposed in the bank of the Blue Rock Road north of the DeWeld Mica Company's concentrating plant, strikes northeast and traverses the ridge above the road. The deposit apparently becomes finer grained northeast of the crest of the ridge but is covered with overburden at numerous places.

The alaskite is relatively coarse grained from the road to a short distance northeast of the crest of the ridge. Semi-kaolinized feldspar was encountered in hand auger holes in the woods on the ridge and hard rock is known to occur at shallow depths at numerous places. In the field toward the southeast, however, it appears to be weathered to a sufficient depth for mining.

Sufficient work was not done to give an accurate tonnage estimate for the deposit.

Sample Results:

Sample No.	*Plus 8 Mesh Mica*	*Minus 8 Mesh Mica*	*Total Mica*
1	4.0%	12.6%	16.6%

Sample No. 1. A composite sample from three hand auger holes taken across the strike of the deposit on the crest of the ridge above the Blue Rock Road.

Another deposit traverses an old road in the woods east of Mr. Edge's house. Although this deposit was not mapped in detail, it appears to have a maximum width of about 75 feet and an average width of from 40 to 50 feet. It can be traced along the strike for a distance of over 200 feet. The width increases down the ridge southwest of the old road. Indications are that hard rock will be encountered at a shallow depth near the bottom of this ridge. To the northeast the formation becomes narrower and much of it is

covered with overburden. Hard rock is to be expected at a shallow depth 150 to 200 feet northeast of the old road.

Most of the deposit appears to contain a relatively high percent of plus 8 mesh mica.

Sample Results:

Sample No.	*Plus 8 Mesh Mica*	*Minus 8 Mesh Mica*	*Total Mica*
1	10.0%	11.7%	21.7%
2	6.7	11.08	17.78

Sample No. 1. A composite sample from three hand auger holes taken across the strike of the deposit in the old road.

Sample No. 2. A composite sample from four hand auger holes taken across the strike of the deposit about 150 feet southwest of the location of Sample No. 1.

An alaskite body is exposed in tunnels and pits about one mile northeast of Mr. Edge's house, in the low gap southeast of Blue Rock Knob. The deposit strikes northeast, is from 50 to 75 feet wide, and extends for a considerable distance both to the northeast and southwest of the gap. The average plus 8 mesh mica content of the deposit is approximately 4 percent.

The alaskite appears to be weathered to a depth of nearly 30 feet in the gap but hard rock should be encountered at a shallow depth along the sides of the ridge near the gap.

The inaccessibility of the deposit will make mining and processing difficult.

Sample Results:

Sample No.	*Plus 8 Mesh Mica*	*Minus 8 Mesh Mica*	*Total Mica*
1	3.75%	11.86%	15.60%

Sample No. 1. A composite sample taken from tunnels and old mine pits near the gap.

Several other deposits examined in this area were fine grained, narrow, or inaccessible.

ED YOUNG SCRAP MICA DEPOSITS

The deposits are located in the eastern part of Yancey County, 2.2 miles S82°E of Micaville, and are adjacent to U. S. Highway No. 19E and the Ed Young Road. (Figure 5, Location 14). They are on the property of Ed Young and brothers of Newdale. The only workings are small prospect pits on the No. 2 deposit (see Plate No. 5) located in the woods above the northeast corner of the field.

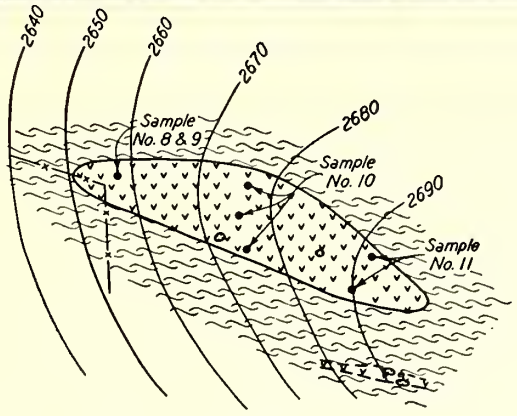
The country rock is mica schist which, in general, strikes north but is folded and at places strikes northwest. It dips steeply to the east.

The deposit is composed of several lens-shaped bodies, the largest of which traverses U. S. Highway No. 19E and the Ed Young Road. Smaller bodies are in the field above the road. The width of the alaskite varies from a few feet to over 150 feet. There are two bodies on the ridge that have a width of 50 feet or more, one of these being 85 feet wide near the center section and about 200 feet long. The width decreases rather uniformly toward both ends. The No. 2 deposit has a maximum width of 60 feet and is about 250 feet long. Numerous small alaskite stringers, not shown on Plate 5, occur in the schist. It is very probable that other mineable lens-shaped bodies occur in the immediate area. No inclusions were observed in the alaskite. If inclusions are encountered, it is believed they will be too small to interfere greatly with mining.

These deposits contain a relatively high percent of plus 8 mesh mica, however, the total content varies considerably. Indications are that the plus 8 mesh mica content will average 6 percent or above. Very little biotite was observed.

The depth of weathering varies considerably for the various deposits. Semi-kaolinized and some hard feldspar occur in the road bank of U. S. Highway No. 19E and above the road. Hard rock will probably be encountered at a depth of 20 or 25 feet in this area. Near the crest of the ridge, weathering is believed to extend to a greater depth; consequently, there should be 30 to 40 feet of mineable material.

A deposit composed of numerous lens-shaped bodies does not afford as good conditions for hydraulic mining as is usually found in a larger consolidated deposit. Considering the quantity of ore and the topo-



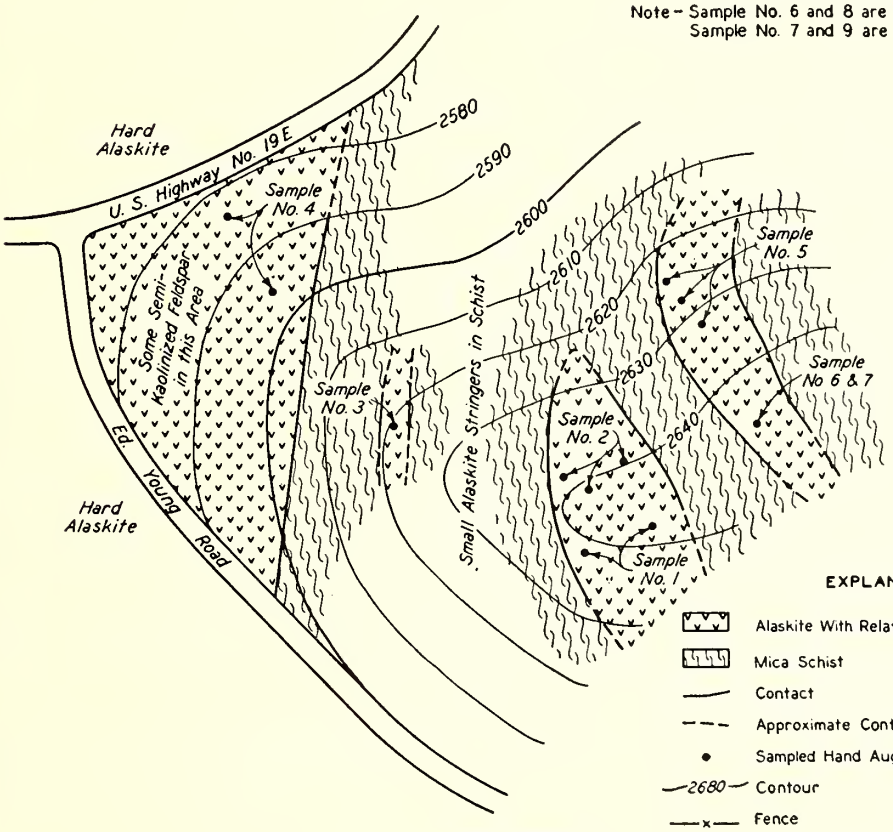
NO. 2 DEPOSIT

N

SAMPLE RESULTS – PERCENT

Sample No.	+8 Mesh Mica	-8 Mesh Mica	Total Mica
1	8.0	14.40	22.40
2	1.17	20.20	21.37
3	3.86	13.50	17.36
4	6.25	13.78	20.03
5	3.32	8.60	11.92
6	4.97	12.48	17.45
7	4.29	9.20	13.49
8	6.54	8.53	15.07
9	5.54	10.12	15.66
10	8.42	12.78	21.20
11	8.54	18.80	27.34

Note – Sample No. 6 and 8 are from 2 to 5 ft depth
Sample No. 7 and 9 are from 5 to 15 ft depth



EXPLANATION

- Alaskite With Relatively High Mica Content
- Mica Schist
- Contact
- Approximate Contact
- Sampled Hand Auger Holes
- 2680 Contour
- Fence

NO. 1 DEPOSIT

ED. YOUNG SCRAP MICA DEPOSIT

YANCEY COUNTY, NORTH CAROLINA

60 0 60 120
Scale in Feet

graphic location, it would be very difficult to mine the material and to wash it to a concentrating plant. This would be especially true for the material from the deposit adjacent to the road, as sufficient fall cannot be obtained there. The ore could be mined with power implements and hauled to either one of several plants located close to the deposit.

Assuming an average depth of weathering of from 25 to 30 feet, the reserves are estimated to contain from 100,000 to 120,000 tons of material that will average about 5 percent plus 8 mesh mica.

Sample results are given on Plate 5.

Another deposit is located approximately 0.3 of a mile south of Highway 19E and traverses the old Blue Rock Road below Clinton Brewer's house. This alaskite body is approximately 200 feet wide and strikes from N10°E to N25°E. Although it was not outlined in detail, it is known to extend for a considerable distance to the southwest and apparently is an off-shoot from the large alaskite body described as the Brewer-Robinson deposit. The alaskite is much finer grained than that of the deposits described on the Ed Young property and is believed to contain an average plus 8 mesh mica content of over 3 percent with a total mica content of around 15 percent. One sample contained 5.4 percent plus 8 mesh mica, however, there appears to be only a small quantity of this material, as fine-grained alaskite was encountered in hand auger holes west of the old road. No samples were taken there as it appeared to be representative of the material in Sample No. 2.

Very little biotite was observed and the material appears to be weathered to a sufficient depth for mining. The deposit appears to have commercial possibilities only if the minus 8 mesh mica is recovered.

Sample Results:

Sample No.	*Plus 8 Mesh Mica*	*Minus 8 Mesh Mica*	*Total Mica*
1	5.40%	11.85%	17.25%
2	1.64	10.10	11.74

Sample No. 1. A composite sample from three hand auger holes taken in the old Blue Rock Road on the north side of the deposit.

Sample No. 2. A trench sample taken from the bank of the old Blue Rock Road on the south side of the deposit.

There are other alaskite deposits in the area but time did not permit a detailed investigation.

FAWN KNOB DEPOSIT

The Fawn Knob Deposit is located in the eastern part of Yancey County, 2.7 miles S50°E of Micaville and 0.3 of a mile east of the Blue Rock Road. (Figure 5, Location 15).

The Newdale Mica Company has been producing scrap mica from the deposit since the spring of 1950. The deposit consists of two alaskite bodies, both of which contain a high percent of plus 8 mesh mica. The deposit occurs on the crest of a steep ridge at an elevation in excess of 3000 feet. It is weathered much deeper than most deposits with a similar topographic location.

A detailed examination of the deposit was not necessary since most of the workable material is exposed by open cuts.

Sample Results:

Sample No.	*Plus 8 Mesh Mica*	*Minus 8 Mesh Mica*	*Total Mica*
1	4.5%	12.9%	17.4%
2	6.0	16.3	22.3
3	10.6	10.6	21.2

Sample No. 1. Average plant feed of the hard materials.

Sample No. 2. Average sample from the upper cut.

Sample No. 3. Average sample from the lower cut.

FREEMAN DEPOSIT

This occurrence is in the northeastern part of Yancey County, 2.8 miles N17°E of Micaville and is adjacent to the abandoned clay pits near Lunday. (Figure 5, Location 16). It can best be reached by taking the Micaville-Double Island School Road to the abandoned clay pits. The deposit is approximately 200 feet above the road and is exposed in the road bank east of Theodore Freeman's house. It is on the properties of Theodore Freeman, Route 1, Green Mountain, North Carolina, and Carolina Mineral Company, Kona, North Carolina. The major part of the deposit is on Mr. Freeman's property. The only workings consist of small prospect pits most of which are less than 3 or 4 feet deep. (See Plate 6).

The country rock bordering the alaskite body on the southeast is hornblende gneiss. Mica schist and hornblende gneiss, occurring together in narrow bands and in varying proportions, are present along the northwest contact. The rock strikes approximately N30°E and dips from 30 to 35° to the southeast. Overburden, consisting of clay and hornblende gneiss, ranges from 3 to 6 feet thick on the southeast side of the deposit. This overburden completely obscures the contact. A hornblende gneiss inclusion, varying from 15 to 50 feet in width, occurs in the southeastern part of the body.

The major part of the deposit, which strikes approximately N30°E, varies from 120 to 375 feet in width and is more than 800 feet long. Drilling on this deposit disclosed that the mica content varies considerably. Samples from some of the drill holes contain a very low percent of mica, especially in an area from 75 to 200 feet south of Mr. Freeman's house. At numerous other drill holes, material with a low mica content was encountered. Biotite occurs in varying proportions throughout the deposit but is most highly concentrated near the hornblende inclusion.

When the alaskite was intruded into the gneiss, solutions undoubtedly reacted with and to some degree dissolved some of the hornblende, thereby acquiring a relatively high iron content which is necessary to produce biotite. It is estimated that biotite makes up from 2 to 10 percent of the mica throughout the body. Zones of fine mica and areas that contain a high percent of biotite will make up at least 50 percent of the deposit.

The greater portion of the alaskite appears to be weathered to a depth of 30 or 40 feet and in places to 50 feet or more. Hard rock will be encountered at a shallow depth in the broad hollow below the road and probably in local areas on the southwest end of the body.

In general, the highest percent of plus 8 mesh mica is found on the southeast part of the deposit. Material from this section appears to contain an average of from 4 to 5 percent plus 8 mesh mica, whereas that in the northwestern part contains from 3.5 to 5 percent. Both average from 9.5 to 10 percent total mica.

At the present time this deposit is considered marginal. It will be very difficult to concentrate a high-grade mica product because of the high percentage of biotite, although certain grades of roofing mica can be produced. The topography surrounding the deposit would make hydraulic mining relatively easy, and the deposit is close to an adequate water supply, being approximately 1200 feet from the South Toe River. There is a good plant site and ample dumping ground north of the deposit.

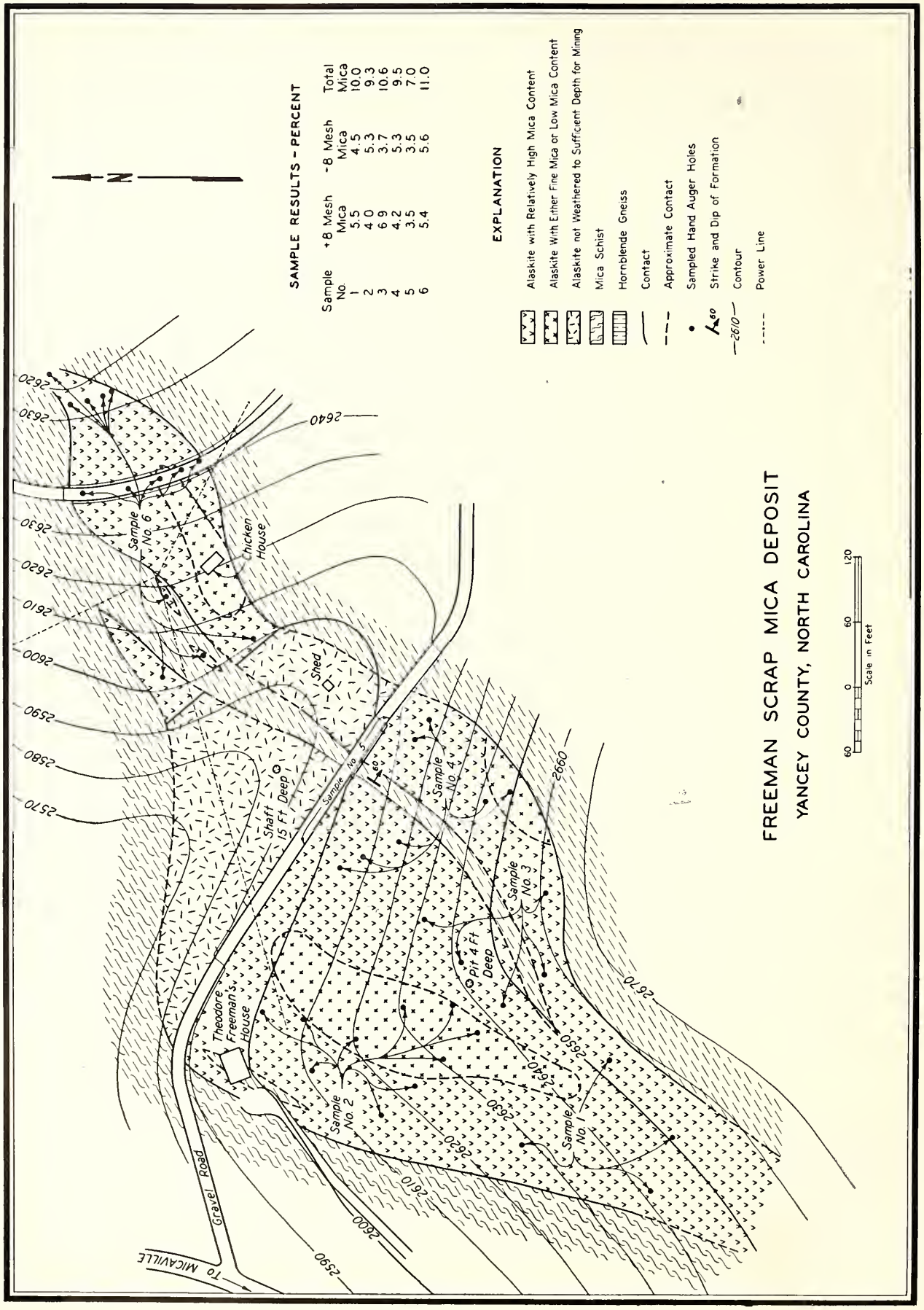
It is estimated that inclusions will make up from 15 to 20 percent of the deposit and that 35 to 40 percent of the deposit will be relatively fine grained. Assuming an average depth of weathering of from 35 to 40 feet the reserves are estimated at from 175,000 to 225,000 tons of material that will average from 4 to 5 percent plus 8 mesh mica and from 100,000 to 125,000 tons of material that will average from 3.5 to 4 percent plus 8 mesh mica. It is estimated that the deposit contains from 275,000 to 350,000 tons of material having a total mica content of from 9 to 10 percent.

Sample results are given on Plate 6.

GUSHER KNOB DEPOSIT

The deposit is located in the southwestern part of Avery County, 6 miles N42°E of Spruce Pine. (Figure 5, Location 17). Harris Clay Company has been producing kaolin from the Gusher Knob deposit since around 1944. Scrap mica is being recovered as a by-product.

A sizeable area east of Gusher Knob is underlain by a relatively fine-grained weathered alaskite containing only a small percent of plus 8 mesh mica. The mica content varies considerably in different parts of the deposit. Some of the alaskite contains as much as 15 percent mica but much of it has less than 10 percent.



BULLETIN 66—PLATE 6

Weathering has progressed to a much greater depth than is generally found in alaskite in the Spruce Pine district. Soft material has reportedly been encountered at depths greater than 80 feet at places on the deposit.

The deposit was not examined in detail and no samples were taken.

H. W. YOUNG DEPOSITS

The deposits are located in the eastern part of Yancey County 2.7 miles S40°E of Micaville, on the west side of the Blue Rock Road and southwest of Fawn Mountain. (Figure 5, Location 18). The property is owned by H. W. Young, Route 2, Burnsville, North Carolina.

There are numerous mine and prospect pits in a deposit on the west side of the Blue Rock Road and north of Mr. Young's house. This deposit is a continuation of the S. M. Edge deposit. It was not mapped because much of the area is covered with overburden. It appears to consist of a series of lens-shaped alaskite bodies which probably vary in width from a few feet to about 100 feet. They have been exposed by mine and prospect pits for a distance of over 800 feet to the southwest, although it is unlikely that alaskite bodies occur over the entire area. Large areas, especially near the small branch southwest of the road, are covered with overburden. Indications are that numerous inclusions will be found throughout the deposits.

In general the deposits contain a relatively high percent of plus 8 mesh mica, but the mica content and size vary considerably. The depth of weathering appears to be very irregular. Since hard rock is exposed in many of the mine pits, it is probable that hard rock will be encountered at shallow depths over much of the area. This may be true especially on the sides of the hill near the branch as well as between the branch and the Blue Rock Road.

Sufficient work has not been done to give estimates of the tonnage or accurately appraise the production possibilities of the deposit, nevertheless it is believed worthy of a more detailed investigation, especially the area southwest of the branch.

Sample Results:

Sample No.	*Plus 8 Mesh Mica*	*Minus 8 Mesh Mica*	*Total Mica*
1	5.00%	8.50%	13.50%
2	2.60	7.78	10.38
3	5.90	7.35	13.25
4	4.50	9.00	13.50
5	16.20	11.64	27.84
6	9.67	10.88	20.55
7	7.45	14.80	22.25

Sample No. 1. Composite sample taken from three old mine pits near the fence approximately 150 feet below the road.

Sample No. 2. Trench sample taken from the long open cut in the woods approximately 140 feet below the road.

Sample No. 3. Composite sample taken from two small mine pits approximately 20 feet south of the location of sample No. 2.

Sample No. 4. Composite sample taken from three small mine pits approximately 35 feet south of the location of sample No. 3.

Sample No. 5. Trench sample from an old mine pit in the woods approximately 220 feet below the road and 130 feet south of the fence.

Sample No. 6. Composite sample taken from two small mine pits on the hill southwest of the branch.

Sample No. 7. Composite sample taken from two mine pits on the western edge of the deposit approximately 75 feet south of the location of sample No. 6.

Another deposit occurs in the small field south of the fork in the road approximately 400 yards south of the deposit described above. It traverses the Blue Rock Road south of the fork. The deposit is lens-shaped, has a width of 30 or 35 feet and appears to be from 150 to 175 feet in length. The alaskite is relatively

coarse grained, containing an average plus 8 mesh mica content of 6 or 7 percent. It is probably weathered to a depth of 35 or 40 feet.

Sample Results:

Sample No.	*Plus 8 Mesh Mica*	*Minus 8 Mesh Mica*	*Total Mica*
1	5.36%	12.21%	17.57%
2	6.67	10.00	16.67

Sample No. 1. A composite sample from three hand auger holes taken across the strike of the deposit.

Sample No. 2. A composite sample from two hand auger holes taken across the strike of the deposit on the west side of the Blue Rock Road.

The Monaqua Mining Company has been producing scrap mica for about ten years from a series of lens-shaped bodies on the ridge south of the road fork. The ore is pushed or hauled with a bulldozer to a stockpile above the plant and washed from there to the plant.

These deposits seldom exceed 50 or 60 feet in width but contain a relatively high percent of plus 8 mesh mica.

Sample Results:

Sample No.	*Plus 8 Mesh Mica*	*Minus 8 Mesh Mica*	*Total Mica*
1	7.80%	9.68%	17.48%

Sample No. 1. A trench sample from the northeast end of the large open cut on the crest of the ridge.

LONG BRANCH DEPOSIT

The deposit is located in the eastern part of Yancey County, 2 miles S85°E of Micaville and west of the Newdale Presbyterian Church. (Figure 5, Location 19). The mineral rights on the property belong to Harris Clay Company, Spruce Pine, North Carolina.

A large body of alaskite occurs on the side of the ridge north of Highway No. 19E. The present workings consist of mine and prospect pits in the woods and a tunnel approximately 150 feet long near the old road west of the church. This body has been drilled rather extensively to determine the quality and quantity of kaolin.

The deposit is over 1500 feet long, in places as much as 1000 feet wide, and has a general northeast strike. Numerous pegmatites are found near the contacts, especially on the northern side of the body, and some sheet mica has been mined from them.

The alaskite is fine grained, but in places contains small pegmatites which have a high percent of plus 8 mesh mica. The pegmatites appear to be small and sporadic in occurrence and do not contian a large tonnage of ore. The main body, although fine grained, contains a relatively high percent of mica, especially along the ridge north of the creek. In this area the average mica content is estimated to be approximately 16 percent. The alaskite is finer grained to the northwest.

The deposit has good production possibilities for the recovery of fine mica. Previous drilling indicates that a good grade of kaolin occurs in the northwest part of the deposit. The recovery of kaolin should be given serious consideration in the event of scrap mica production.

It is estimated that the deposit contains from 1,200,000 to 1,600,000 tons of ore.

Sample Results:

Sample No.	*Plus 8 Mesh Mica*	*Minus 8 Mesh Mica*	*Total Mica*
1	4.8%	11.3%	16.1%

Sample No. 1. A trench sample from the tunnel at the old road west of the church.

MAYBERRY DEPOSIT

The Mayberry Scrap Mica Deposit is located in the eastern part of Yancey County, 1.3 miles N80°E of Celo, between Bailey Mountain and the South Toe River. (Figure 5, Location 20). The northern part of the deposit traverses the Browns Creek Road at a point approximately 1.5 miles east of Celo. The mineral rights on the property belong to Mr. Jim Mayberry, Spruce Pine, North Carolina.

Numerous mine and prospect pits occur in or near the deposit, the largest ones being in pegmatites near the alaskite contacts. A considerable amount of sheet mica has been produced from the Jimmy Cut and other mines in these pegmatites.

The country rock is mica schist, which has a general strike of from north to N15°E. Near the road the schist dips approximately 70° to the west, however, the prevailing dip of rocks in that area is to the east. It is very probable that much of the schist surrounding the deposit dips steeply to the east. Numerous pegmatites occur in the schist, particularly along the west contact. Near the northern end of the deposit a relatively long pegmatite, roughly paralleling the body, is well exposed by mine pits and shafts. This pegmatite is located about 70 feet west of the alaskite body.

It is believed to be the largest undeveloped deposit containing a high percent of plus 8 mesh mica in the Spruce Pine district. The width varies from 100 to over 200 feet with an average of from 120 to 150 feet. The alaskite body has an overall length of over 2000 feet, although it appears to pinch out at one place. Although the deposit varies some in width, the boundaries are relatively uniform for a distance of about 1200 feet north of the road. The contacts could not be determined accurately in the large draw north of the road because of an excessive amount of overburden, but indications are that it pinches out at this point and that a different body is present to the north. Hereinafter the southern body will be referred to as the No. 1 deposit and the northern body as the No. 2 deposit. Contacts were not accurately determined on the northern end of the No. 2 deposit because of the presence of numerous schist inclusions and a considerable amount of fine-grained material. (See Plate 7).

Schist inclusions occur at many places throughout the deposit, but are much larger and apparently more plentiful on the northern end of the No. 2 deposit. It is estimated that inclusions make up approximately 10 percent of the deposit except on the northern end, where they comprise up to 50 percent in places.

The alaskite is coarse grained, containing a high percent of plus 8 mesh mica. Although there is some variation, the No. 1 deposit appears to have a relatively uniform texture, and indications are that it will average from 6 to 7 percent plus 8 mesh mica. Near the edge of the woods on the northern end it is fine grained, although the amount of fine-grained material makes up only a very small percent of the deposit.

The No. 2 deposit has a greater variation in texture. Samples from it contained from 3.7 to 7.6 percent plus 8 mesh mica. The average plus 8 mesh mica content of the deposit is believed to be approximately 5 percent. Very little biotite was observed in either deposit.

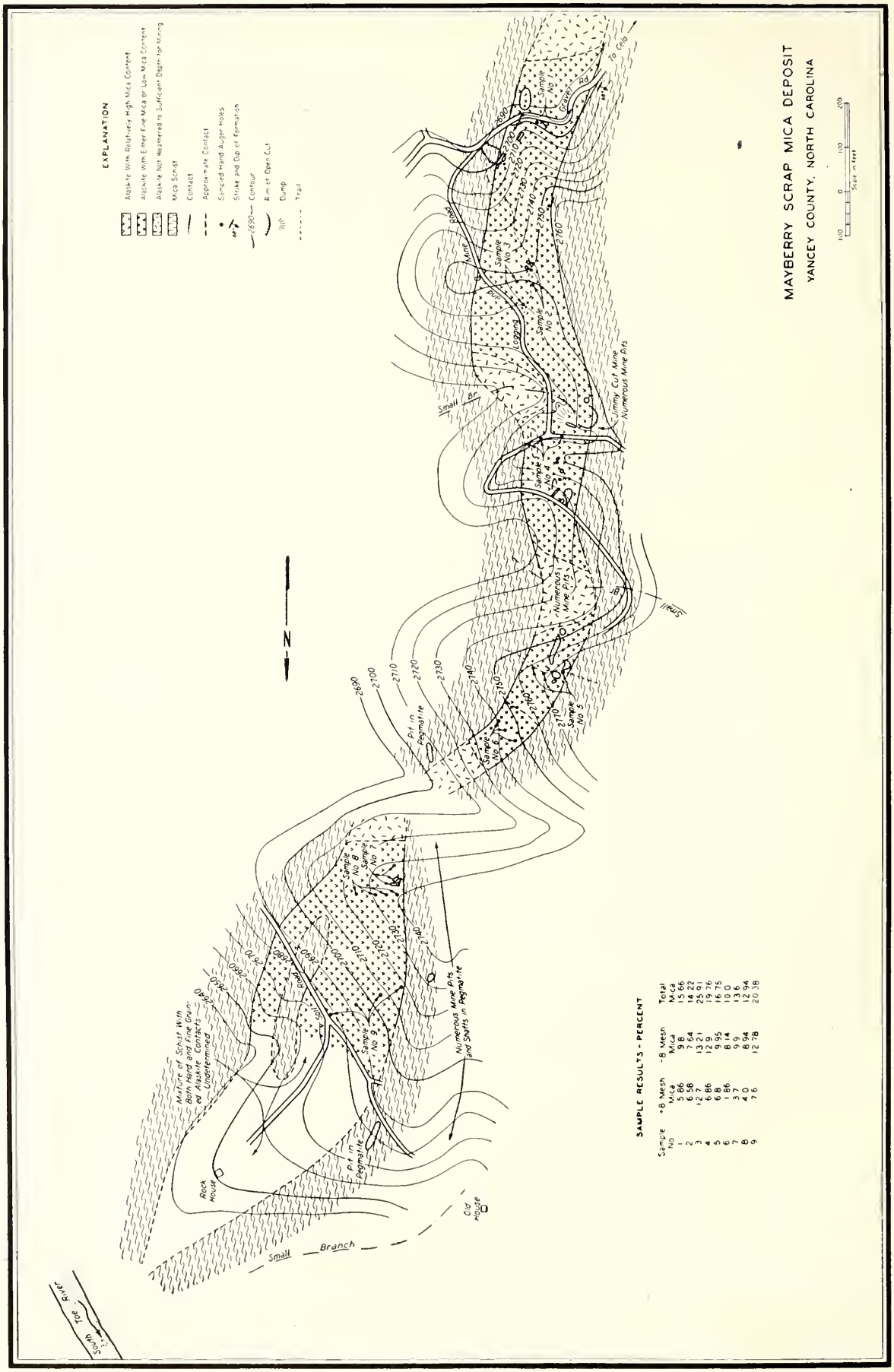
Hard rock will be encountered at a shallow depth in the local areas, but most of the material appears to be weathered to a depth of from 35 to 40 feet and probably to 50 feet in places. Hard rock is exposed near the large draw between No. 1 and No. 2 deposits.

The deposit is believed to offer better possibilities for the production of plus 8 mesh mica than that of any other examined. The South Toe River parallels the deposit a few hundred to 1000 feet to the east. Such factors as this water supply, the unusually large deposit, the high percent of plus 8 mesh mica, and the apparent deep weathering makes the deposit an important one as a potential source of scrap mica. With some bulldozer work, most of the material could be mined hydraulically and washed to different plant locations between the deposit and the South Toe River. For the most efficient mining, a plant would have to be moved three or four times in working the entire deposit.

Assuming that inclusions make up 10 percent of the deposit and an average depth of weathering of between 35 and 40 feet, the reserves for the No. 1 deposit are estimated to be from 400,000 to 450,000 tons of material that will average between 6 and 7 percent plus 8 mesh mica. The reserves of the No. 2 deposit are estimated to be from 175,000 to 200,000 tons of material that will average about 5 percent plus 8 mesh mica.

Sample results are given on Plate 7.

Another deposit occurs near the old road on a spur ridge on the southeast side of Bailey Mountain. It is about 0.13 of a mile west of the deposit described above.



BULLETIN 66—PLATE 7

Numerous mine and prospect pits have been made in pegmatites and narrow alaskite bodies which traverse the old road. All the deposits examined in this area are either small or consist of such fine-grained material that they do not appear to have commercial possibilities for the production of scrap mica.

Sample Results:

Sample No.	*Plus 8 Mesh Mica*	*Minus 8 Mesh Mica*	*Total Mica*
1	1.60%	7.27%	8.87%
2	2.85	14.50	17.35

Sample No. 1. A composite sample from three hand auger holes taken along the road on the crest of the hill.

Sample No. 2. A composite sample from three hand auger holes taken on the side of the hill east of the old road.

MICAVILLE DEPOSIT

The Micaville deposit is located 0.5 of a mile east of Micaville on the south side of Highway 19E. (Figure 5, Location 21).

The deposit has been worked for scrap mica for about 10 years and has produced more scrap mica than any other deposit in the Spruce Pine district. Until recently three scrap mica plants were producing from the deposit and two are producing at present (1951).

The deposit has a maximum width of about 150 feet and is apparently over 2000 feet long. Contacts are irregular and large inclusions are found at various places throughout the deposit.

The alaskite contains a relatively high percent of plus 8 mesh mica. A representative sample from the open cut on the eastern end of the deposit contained 6.5 percent plus 8 mesh mica and had a total mica content of 15.9 percent.

NEWDALE SCRAP MICA DEPOSIT

The deposit is located in eastern Yancey County, 1.6 miles S76°E of Micaville on the ridge above Long Branch. (Figure 5, Location 22). It can be reached by taking the unimproved road 0.1 of a mile west of Newdale Post Office and following it to the top of the ridge above Southern Mica Company's plant. The deposit is on the properties of Newdale Mica Company, Kona, North Carolina, and the heirs of R. L. Young.

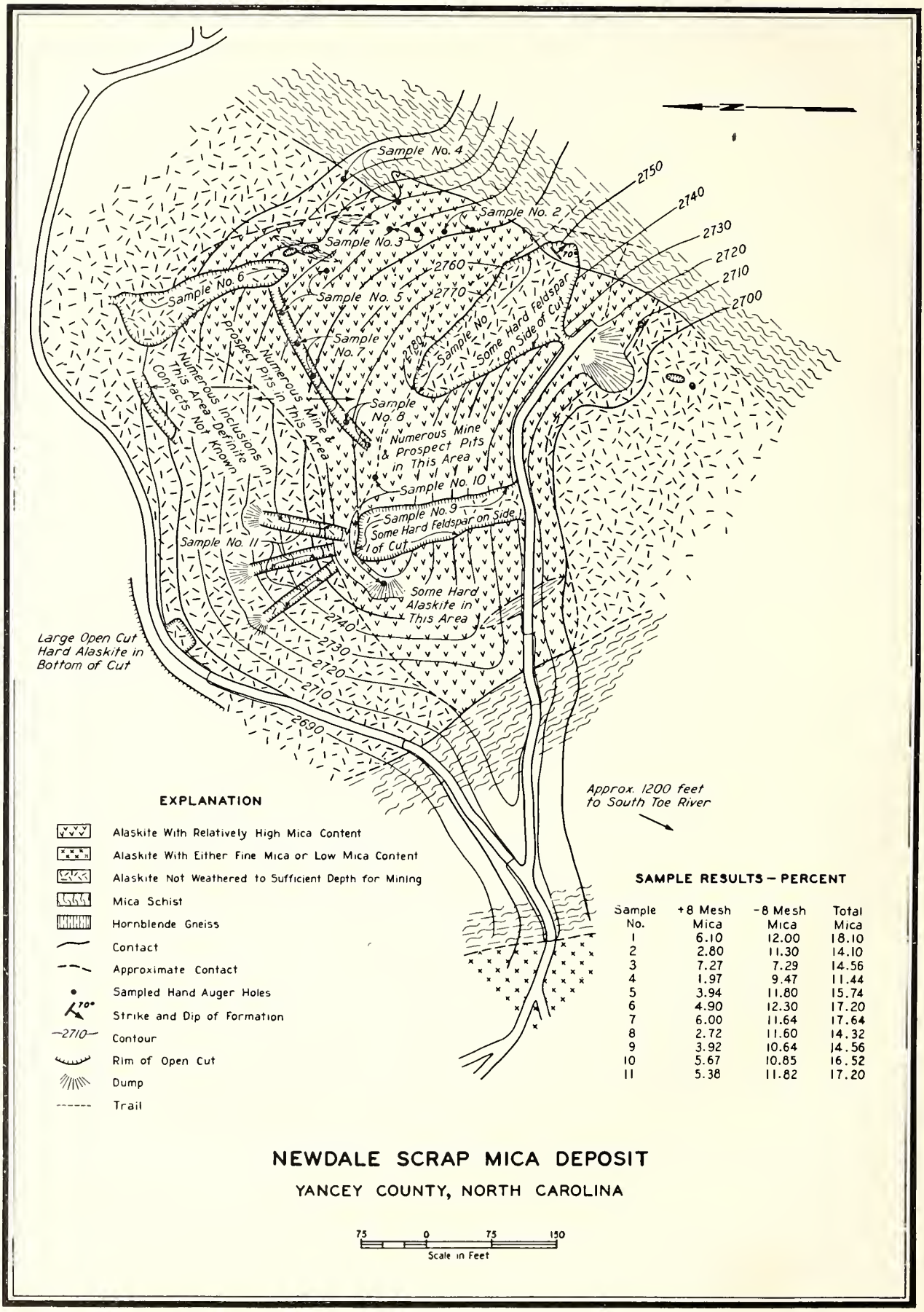
The deposit has been worked for both sheet and scrap mica at numerous times in the past. Scrap mica was produced from the two large open cuts near the crest of the ridge and from the cut above the road. Material from the two large cuts was mined with a power shovel and hauled to a concentrating plant. That from the cut above the road was mined hydraulically. Several bulldozer cuts have been made in the deposit recently while prospecting for scrap mica.

In addition to the three large pits shown on Plate 8, there are numerous small mine and prospect pits throughout the deposit. No attempt was made to locate all these small pits on the map.

The country rock is hornblende gneiss and mica schist, often occurring together in zones from 3 to 6 feet wide and in varying proportions. The predominant rock near the contacts is hornblende gneiss. The country rock on the southeast contact strikes from N20°E to N60°E with an average strike of N30°E and dips steeply to the southeast. On the southwest side it has an average strike of approximately N35°W and dips steeply to the northeast. The alaskite ranges from 350 to over 600 feet in width and is about 600 feet long. Numerous schist inclusions, some fine-grained material, and a considerable quantity of hard rock occur throughout the body.

Small inclusions are present throughout most of the deposit but are larger and more numerous in the northeast side, especially in the area north of the long bulldozer cut. They are estimated to make up about 10 percent of the body.

The texture of the material varies considerably. Some areas contain a relatively high percent of plus 8 mesh mica and others contain fine-grained material. Gradation between the two precluded an attempt to separate the zones of coarse and fine material on the map. The highest concentrations of plus 8 mesh mica



BULLETIN 66—PLATE 8

was encountered in the field northeast of the large open cut and near the southeastern contact. This material, however, contains some biotite and grades into finer-grained alaskite down the hill. In general, the northern part of the body is finer grained and grades into coarser material near the crest of the ridge.

Some biotite is present throughout most of the deposit but is found in greater quantities near the contacts and inclusions. It will be very difficult to produce a mica concentrate from this deposit that does not contain some biotite. In general, the areas which contain the highest percent of plus 8 mesh mica also contain the highest percent of biotite. This is not unusual for a deposit of this type.

Weathering on the body is very irregular. In places along the crest of the ridge the alaskite is weathered to a depth of 50 feet, but in other places it is only a few feet to hard rock. In the large pit, weathered material was mined to a depth of 45 feet, but in the pit to the north hard rock was encountered at a depth of from 15 to 20 feet. Hard alaskite is present at very shallow depths in the three bulldozer cuts north of the long pit. It is very difficult to determine the areas of weathered material without some exploration work, however the average depth of weathering of the deposit is estimated to be from 25 to 30 feet. Some hard alaskite will be encountered in the area shown on Plate 8 as "alaskite with relatively high mica content."

The deposit appears to have good production possibilities, especially for the recovery of both plus 8 and minus 8 mesh mica. The recovery of fine mica should be given serious consideration before a concentrating plant is erected. Most of the deposit is well situated for hydraulic mining. The South Toe River is approximately 1300 feet southwest and 1700 feet northwest of the deposit.

Assuming inclusions make up 10 percent of the body and the average depth of weathering is from 25 to 30 feet, reserves are estimated to be from 200,000 to 225,000 tons of ore. Of this, about 20 percent will probably be fine-grained material.

Sample results are shown on Plate 8.

A rather large alaskite body occurs approximately 250 feet west of the one described above. Some scrap mica has been produced from the deposit but it is relatively fine grained, averaging around 4 percent plus 8 mesh mica.

NICHOLS-GRINDSTAFF DEPOSIT

The deposit is located in the eastern part of Yancey County, 1.8 miles N60°E of Celo, and is on the ridge above Roy Nichols' home approximately 200 yards east of the Blue Rock Road. (Figure 5, Location 23). It is on the properties of Roy Nichols and Paul Grindstaff, Route 2, Burnsville, North Carolina.

Many small prospect pits are found on the deposit. They are more numerous in the woods south of the small barn and in the wooded area in the field above the barn. Most of them are small and apparently were made while prospecting for sheet mica.

The deposit has a general strike of from N10°E to N30°E. It is approximately 275 feet wide at the barn and increases in width northeastward, being over 500 feet wide near the woods on the ridge. It decreases in width, apparently rather uniformly, toward the south. A narrow zone of hard alaskite is exposed in the road bank north of Mr. Nichols' house. This appears to be an extension of the deposit on the ridge. Some schist inclusions were encountered in drill holes, but sufficient information was not obtained to estimate their size or abundance.

For the most part the deposit is relatively fine grained, although there are numerous pegmatites in the alaskite body which locally produce a high percent of coarse mica. The alaskite north of the barn appears to be finer grained than that south of the barn and averages around 3.0 percent plus 8 mesh mica. The total mica content is approximately 15.0 percent. To the south there are local zones, up to 20 feet wide, that contain a high percent of plus 8 mesh mica but which are surrounded by fine-grained material. Therefore, the total plus 8 mesh mica content of alaskite in this section may be low. Of the six samples taken over the entire deposit the average mica content was 15.42 percent.

Indications are that hard rock will be encountered at a shallow depth for at least 200 feet above the road. The alaskite on the ridge is probably weathered to a depth of 30 or 40 feet.

The deposit appears to have commercial possibilities only if the fine mica is recovered, otherwise it would be a marginal operation.

Sample Results:

Sample No.	*Plus 8 Mesh Mica*	*Minus 8 Mesh Mica*	*Total Mica*
1	2.5%	11.73%	14.23%
2	2.8	10.00	12.80
3	3.1	11.20	14.30
4	7.5	11.50	19.00
5	11.1	10.00	21.10
6	6.6	4.52	11.12

Sample No. 1. Composite sample from four hand auger holes taken across the strike of the deposit north of the fence.

Sample No. 2. Composite sample from three hand auger holes taken across the strike of the deposit on the ridge approximately 375 feet northeast of the barn.

Sample No. 3. Composite sample from three hand auger holes taken on the east side of the deposit approximately 800 feet northeast of the barn and east of the small woods.

Sample No. 4. Composite sample from one mine pit and one hand auger hole east of the small woods and 80 feet southwest of the fence corner.

Sample No. 5. Composite sample taken from two mine pits south of the fence.

Sample No. 6. Composite sample from two hand auger holes approximately 150 feet south of the fence.

PHIPPS BRANCH DEPOSITS

The deposits are located in the eastern part of Yancey County, 4.5 miles S30°E of Micaville, north of Phipps Branch. Some of the deposits traverse the Blue Rock Road. (Figure 5, Location 24).

Several alaskite bodies, some of which are rather large, occur in this area. Most of them are fine grained and contain only a small percent of plus 8 mesh mica. The total average mica content is from 12 to 15 percent. Some of the smaller deposits and local zones in the larger ones contain a relatively high percent of plus 8 mesh mica, although most of the zones are small and do not appear to contain sufficient reserves to justify the erection of a scrap mica concentrating plant.

A large deposit is located about 1.25 miles north of Phipps Branch on the property of Jim Mayberry, Spruce Pine, North Carolina. It is west of the Blue Rock Road and southeast of a deposit formerly worked by the Asheville Mica Company.

This is a relatively large alaskite body and with the exception of a few local zones is essentially fine grained. It contains an average plus 8 mesh mica content of less than 2 percent. The average total mica content is estimated to be between 12 and 15 percent. Near the contacts, especially on the northwest side, there are zones of coarser grained material.

Most of the alaskite appears to be weathered to sufficient depth for mining.

Sample Results:

Sample No.	*Plus 8 Mesh Mica*	*Minus 8 Mesh Mica*	*Total Mica*
1	3.50%	8.10%	11.60%
2	0.03	6.84	6.87
3	1.23	12.80	14.03

Sample No. 1. A sample taken from a mine pit beside the old road in the woods.

Sample No. 2. A composite sample from two hand auger holes taken along the old road approximately 300 feet west of the Blue Rock Road.

Sample No. 3. A composite sample from three hand auger holes taken along the old road approximately 150 feet west of the Blue Rock Road.

A relatively large fine-grained alaskite body crosses the Blue Rock Road approximately 1.5 miles north of Phipps Branch. The plus 8 mesh mica content is low. A sizeable portion of the alaskite appears to be weathered to a sufficient depth for mining.

Sample Results:

Sample No.	*Plus 8 Mesh Mica*	*Minus 8 Mesh Mica*	*Total Mica*
1	0.60%	12.55%	13.15%

Sample No. 1. A trench sample taken for a distance of approximately 200 feet along the east bank of the Blue Rock Road.

Another alaskite body crosses the Blue Rock Road about 0.2 of a mile north of Phipps Branch. A bulldozer cut and numerous pits have been made in the deposit while prospecting for sheet mica. Much of the alaskite is fine grained. However, it contains a higher percent of plus 8 mesh mica than is usually found in that area. A considerable amount of biotite was observed in some of the material. Hard alaskite and semi-kaolinized feldspar are found at numerous places on the ridge above the site, and it is believed that hard rock will be encountered at a shallow depth over most of the deposit.

Sample Results:

Sample No.	*Plus 8 Mesh Mica*	*Minus 8 Mesh Mica*	*Total Mica*
1	5.55%	9.70%	15.25%

Sample No. 1. A trench sample from the bulldozer cut above the Blue Rock Road.

Other deposits similar to the ones described above occur in the area but were not investigated.

ROBINSON-BREWER DEPOSIT

The deposit is located in the eastern part of Yancey County, 1.8 miles S70°E of Micaville. (Figue 5, Location 25). It can be reached from Highway 19E by following the Blue Rock Road south for 0.6 of a mile and taking an old road west for a few hundred feet. The deposit is on the properties of Raymond Robinson, Clinton Brewer, and Ed Young, Newdale, North Carolina. The Newdale Mica Company reportedly owned the mineral rights on some of the property as late as 1951.

The alaskite body is approximately 1500 feet across and extends from the south side of the ridge near the South Toe River over 1500 feet toward the north. Its widest section is near the old road along the crest of the ridges. From this point toward the north, it decreases in width.

Numerous small pegmatites, many of which have been prospected for sheet mica, occur throughout the deposit. The alaskite is essentially fine grained. The plus 8 mesh mica content of four samples taken from the deposit varied from 0.40 to 4.27 percent, the latter not being representative of large quantities of material. The plus 8 mesh mica content of the deposit will probably average about 3 percent. The total mica content of the samples varied from 13.58 to 21.39 percent with an average of 16.94 percent.

The depth of weathering varies considerably for different parts of the deposit, hard rock being exposed at numerous places on the south side of the ridge. Weathering probably extends to about 30 feet along the crest of the ridge and at a few places on the north side.

The commercial possibilities of this deposit will be quite limited unless the fine mica can be recovered. Most of the deposit is well situated for hydraulic mining. The South Toe River is located from 1000 to 2000 feet southwest of the crest of the ridge.

It is estimated that the deposit contains from 800,000 to 1,200,000 tons of ore.

Sample Results:

Sample No.	*Plus 8 Mesh Mica*	*Minus 8 Mesh Mica*	*Total Mica*
1	3.11%	10.47%	13.58%
2	1.11	13.69	14.80
3	4.27	12.00	16.27
4	3.00	18.39	21.39
5	0.40	18.30	18.70

Sample No. 1. Composite sample from four hand auger holes taken in the old road along the crest of the ridge about 300 feet west of Mr. Brewer's house.

Sample No. 2. Composite sample from three hand auger holes taken in the field above Mr. Robinson's house.

Sample No. 3. Composite sample from one hand auger hole and an old mine dump in the field above Mr. Robinson's house.

Samples Nos. 4 and 5. Samples from a series of five hand auger holes taken along the ridge above Mr. Robinson's house. Sample No. 4 is from three holes which contained the most coarse material and Sample No. 5 is from the other two holes which contained fine-grained material.

ROBINSON'S DAIRY DEPOSIT

The deposit is located in the eastern part of Yancey County, 2.1 miles N60°E of Micaville. It can be reached by following Highway No. 80 approximately 1.5 miles north from Highway 19E. The deposit traverses the old road 0.2 of a mile north of the school and is on the property of Robinson's Dairy. Mineral rights belong to Harris Clay Company (1951).

The southern end of the alaskite body is well exposed in the old road. It is from 200 to 250 feet wide at this point. Above the milk house at Robinson's Dairy the deposit is approximately 300 feet wide and either pinches out or becomes very narrow on the hill to the north. The length of the deposit is over 1000 feet. It strikes from N10°E to N20°E.

All of the alaskite examined was relatively fine grained, containing approximately 3 percent plus 8 mesh mica and a total mica content of about 10 percent. Undoubtedly there are areas in the deposit that contain a higher percent of coarse mica, but indications are that they will be small. A considerable amount of biotite was observed, especially along the eastern side of the deposit.

Hard alaskite is exposed in the old road above the milk house and a few other places on the deposit, but indications are that most of the deposit is weathered to a depth of approximately 30 feet, and possibly to a greater depth in places.

Reserves are estimated to be from 500,000 to 750,000 tons of ore.

Sample Results:

Sample No.	*Plus 8 Mesh Mica*	*Minus 8 Mesh Mica*	*Total Mica*
1	2.9%	6.8%	9.7%
2	3.7	7.6	11.3

Sample No. 1. A trench sample taken from the road cut over a distance of approximately 225 feet.

Sample No. 2. A composite sample from seven hand auger holes taken across the strike of the deposit in the woods on top of the ridge north of the old road.

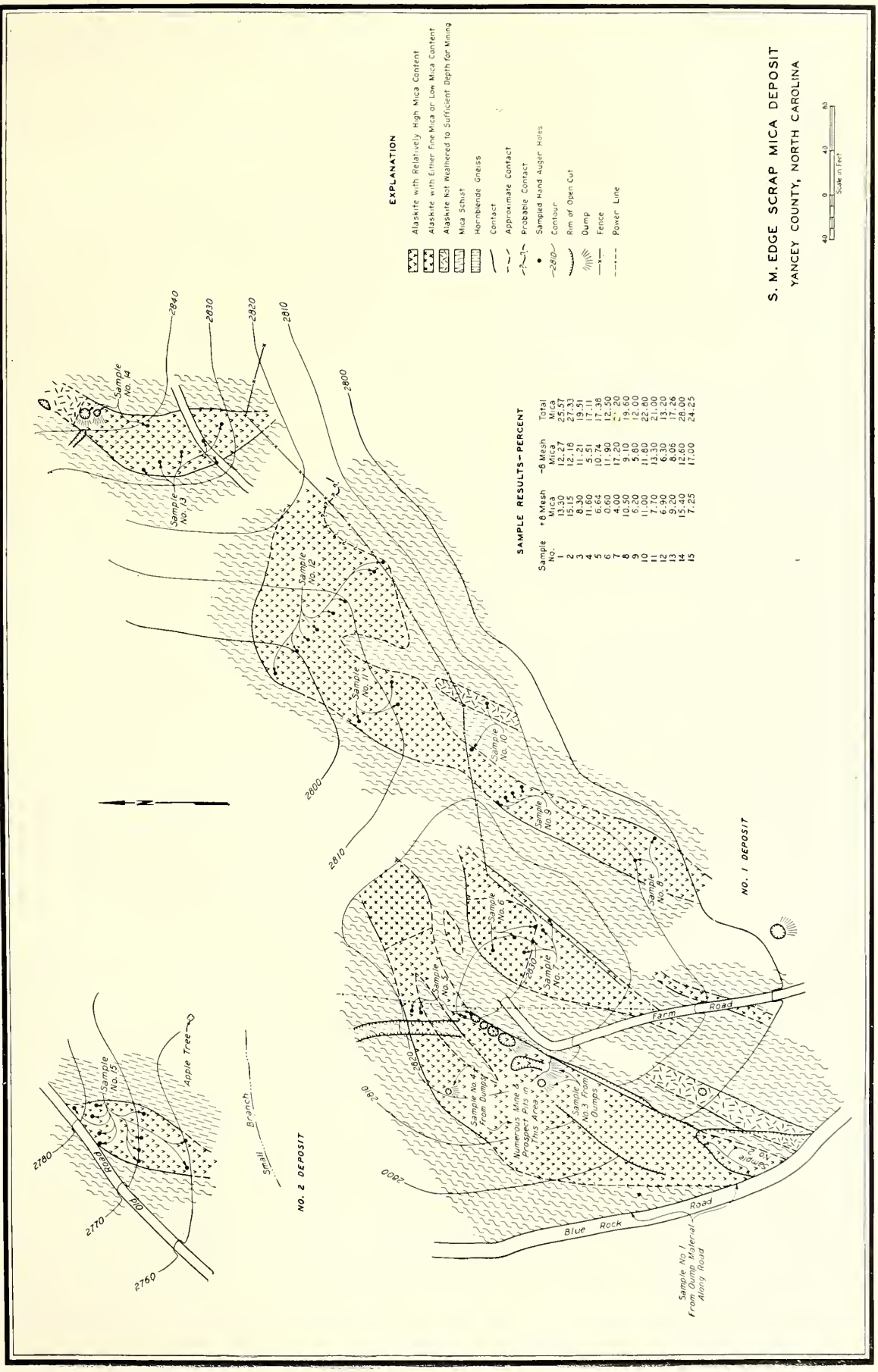
S. M. EDGE DEPOSITS

The deposits are located in the eastern part of Yancey County, 2.7 miles S40°E of Micaville and traverse the Blue Rock Road southwest of Fawn Mountain. (Figure 5, Location 27). They are on the property of S. M. Edge, Route 2, Burnsville, North Carolina.

Some sheet mica and a small amount of scrap have been produced from the deposits. In the spring of 1950 the Newdale Mica Company hauled several truck loads of ore to their plant from a deposit traversing the road. This was to feed their plant while mining preparations were being made on the Fawn Knob deposit. The deposits have been prospected rather thoroughly for sheet and punch mica and contain numerous mine and prospect pits.

The country rock is mica schist which has a general strike of from N30°E to N40°E. It contains numerous folds but, in general, appears to be dipping to the southeast. Some of the schist has been partially altered by alaskite solutions and is now composed of relatively large mica flakes. Stringers and pods of Alaskite occur throughout the schist.

The deposit consists of several lens-shaped bodies of alaskite that contain a high percent of mica. Individual deposits vary from a few feet to approximately 100 feet in width and are as much as 400 feet long. One of the largest bodies traverses the Blue Rock Road near the crest of the ridge. This deposit has a max-



BULLETIN 66—PLATE 9

imum width of almost 90 feet above the road but decreases to 50 feet at the top of the ridge near the power pole. From there to the northeast, it is fine grained. Three other lens-shaped bodies, northeast of this ridge, have maximum widths of from 40 to almost 100 feet (see Plate 9). It is probable that other deposits large enough to mine occur in the area.

Schist inclusions are found at numerous places and probably make up from 10 to 15 per cent of the deposit. Some of the inclusions are shown on Plate 9. It is likely that others exist that may be larger than the ones shown. No attempt was made to locate all of the inclusions.

The alaskite is coarse grained and contains a high percent of large mica. Five of the 14 samples taken on the ridge contained above 10 percent and all but two contained above 5 percent plus 8 mesh mica. The average mica content is believed to be from 7 to 10 percent plus 8 mesh, with a total content of approximately 20 percent. In general, the mica content increases near inclusions and contacts, the alaskite solutions apparently having reacted with the mica schist to produce the high percent of mica. Some large mica books, up to three inches across, were encountered in drilling. It is believed that a considerable amount of punch and probably some sheet mica can be recovered from these deposits. Only a very small amount of biotite was observed. Probably a very good grade of scrap mica can be produced from this ore.

Some hard rock was observed near the road and on the crest of the ridge south of the location of sample No. 11. Hard alaskite may be encountered in some other local zones, but the alaskite appears to have an average depth of weathering of about 30 feet.

The deposits have good production possibilities. They are approximately 1200 feet east of the South Toe River, and a power line traverses the property. A plant could be located either below the road or in the large draw above the road. A larger percent of the material along the ridge could be mined hydraulically and washed to a plant in the latter location, although it appears that some of the ore will have to be hauled regardless of the plant location.

Assuming that inclusions make up from 10 to 15 percent of the deposits and that the average depth of weathering is 30 feet, the reserves are estimated to contain from 110,000 to 135,000 tons of material that will average above 7 percent plus 8 mesh mica.

Sample results are shown on Plate 9.

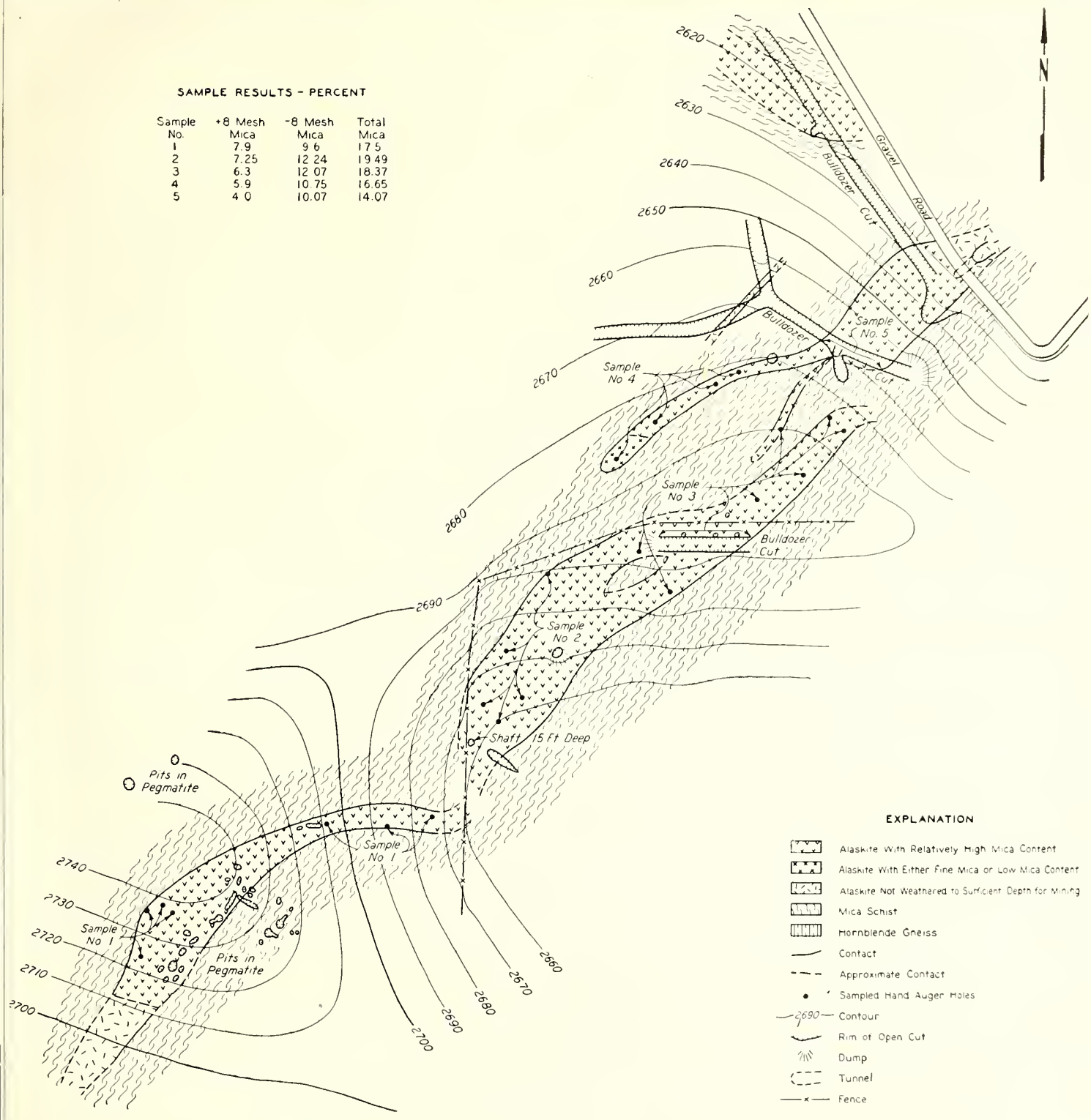
SPARKS-ROBINSON SCRAP MICA DEPOSIT

The deposit is located in the eastern part of Yancey County, 2.6 miles N53°E of Micaville and 0.6 of a mile N87°E of Boonford. (Figure 5, Location 28). It can be reached by following N. C. Highway No. 80 to the North Toe River and taking the gravel road west for 0.5 of a mile. The deposit traverses the road east of Mr. Ed Sparks' house. It is located on the properties of Mr. Ed Sparks and Mr. Bass Robinson, Route 2, Burnsville, and Harris Clay Company. Mr. Sparks owns the property northeast of the fence on top of the hill and Mr. Robinson from this fence to a fence just west of the 15 ft. shaft. Harris Clay Company owns the property to the west.

The deposit has been prospected rather thoroughly for both sheet and scrap mica. Numerous pits and tunnels have been dug in search of sheet mica. Recently several bulldozer cuts have been made on the northeastern part of the deposit to determine the width of and percent of mica in the deposit.

The country rock is mica schist and hornblende gneiss, the former predominating. Hornblende is found along the contacts near the road and extends above the second bulldozer cut. Mica schist occurs near the contacts southwest of this cut. The country rock has an average strike of N45°E and dips steeply to the southeast. Some of the mica schist found in this area is relatively coarse grained and contains a very high percentage of mica.

The alaskite body is irregular in shape. (See Plate 10). Its width varies from less than 20 to as much as 70 feet. It is approximately 1000 feet long. The deposit is between 45 and 50 feet wide above the road but splits into two narrow stringers above the center bulldozer cut. From there to the southwest it "pinches and swells" along the strike and has an average width of about 50 feet. The width is approximately 70 feet southeast of the bulldozer cut on top of the hill, but it decreases near the 15 foot shaft. From the fence west of the shaft to near the crest of the hill the average width is 20 feet. This increases to between 55 and 60 feet southwestward.



SPARKS-ROBINSON SCRAP MICA DEPOSIT

YANCEY COUNTY, NORTH CAROLINA

50 0 50 100

Scale in Feet

BULLETIN 66—PLATE 10

Most of the deposit is relatively free of inclusions. The only one observed was about 20 feet wide southwest of the upper bulldozer cut. However, it may extend for a greater distance than is shown on Plate 10. The average depth of weathering is believed to be between 30 and 40 feet. Some semi-kaolinized feldspar was observed on the side of the ridge above the road.

The deposit contains a relatively high percent of coarse mica. The plus 8 mesh mica content will probably average above 5 percent, but local zones, especially on the northeast end of the deposit, contain finer-grained material. Very little biotite was observed.

There are several factors that influence the production possibilities of the deposit. The body, although long, is very narrow in places. This will make mining difficult. The closest supply of sufficient water is the North Toe River which is about 1250 feet to the northeast. However, only a small percent of the material could be mined hydraulically and washed to a plant northeast of the body. For efficient hydraulic mining a plant should be in the draw near the center of the deposit in which case water would have to be piped a greater distance and the dumping facilities there are not as advantageous as to the northeast. Material from the deposit could be mined with power implements and hauled to a near-by concentrating plant.

Assuming an average depth of weathering of from 30 to 40 feet, the reserves are estimated to be from 75,000 to 100,000 tons of ore.

Sample results are given on Plate 10.

SPRUCE PINE DEPOSITS

The largest alaskite body in the Spruce Pine district occurs in the southern part of Mitchell County, southwest of Spruce Pine. It extends from near the Prison Camp on U. S. Highway 19E to approximately 0.5 of a mile east of the junction of Silver Run and Grassy Creeks. (See Figure 5).

The alaskite has a maximum width of approximately 2 miles, an average width of 0.75 of a mile and is more than 2.5 miles long. It is exposed in the road bank of U. S. Highway 19E from near Spruce Pine to Chalk Mountain and in the banks of N. C. Highway No. 26 in the Sirver Run Creek area. The deposit traverses English Creek, Graveyard Creek, Silver Run Creek, and Grassy Creek.

At many places along, or near, the creeks the alaskite is weathered relatively deep. Hard alaskite is exposed in most of the ridges between the creeks, but in some of the lower ridges it is weathered to a sufficient depth for mining. At many places along the creeks overburden, consisting of clay and gravel, entirely obscures the deposit.

Small pegmatites are found in the deposit, but in general the alaskite is fine grained, seldom containing over 3 to 3.5 percent plus 8 mesh mica, with an average of from 1 to 3 percent.

English Creek Area

Numerous zones of weathered alaskite traverses English Creek, 1 mile S70°W of Spruce Pine. (Figure 5, Location 29). The area can be reached by following U. S. Highway 19E west of Spruce Pine to the Prison Camp and taking the secondary road for 0.3 of a mile south. Mineral rights on most of the deposit are reportedly owned by either Harris Clay Company, Newdale Mica Company, or the Whitehall Company.

The deposit has been prospected rather thoroughly for kaolin and a small amount has been mined from the east side of the creek. The kaolin exposed in the two open cuts contains a relatively high percent of iron.

There are several large areas of weathered alaskite adjacent to the creek. Much of the material along the creek is covered with overburden of clay and loose rock, and it will require some exploration work to determine the depth of weathering of the underlying alaskite. Some schist inclusions are found in the deposits. However, zones of alaskite several hundred feet wide occur where no inclusions were observed.

The alaskite is fine grained, containing only a small percent of plus 8 mesh mica. Mica content varies in different areas but in general is relatively high. An average total mica content of 5 samples was 16.2 percent.

The depth of weathering varies considerably. Some of the material appears to be weathered to a depth of 40 feet or more, the average of the deposits probably being around 30 feet.

The English Creek area is estimated to contain between 4,000,000 and 5,000,000 tons of ore.

Sample Results:

Sample No.	*Plus 8 Mesh Mica*	*Minus 8 Mesh Mica*	*Total Mica*
1	2.0%	20.4%	22.4%
2	0.9	15.8	16.7
3	1.0	13.5	14.5
4	1.0	15.0	16.0
5	1.0	10.7	11.7

Sample No. 1. A trench sample from the large open cut on the north side of English Creek.

Sample No. 2. A trench sample from the small open cut on the north side of English Creek.

Sample No. 3. A composite sample from four hand auger holes on approximately 100 foot centers taken along the old road southeast of the school.

Sample No. 4. A composite sample from three hand auger holes near the road on the small ridge south of English Creek.

Sample No. 5. A composite sample from six hand auger holes taken along the ridge 0.3 of a mile S20°E of the school.

Graveyard Creek Deposit

This deposit is located 1.7 miles S25°W of Spruce Pine and traverses Graveyard Creek. It can be reached by following North Carolina Highway No. 26, 1.5 miles south of Spruce Pine, turning south on the gravel road of the recreation lake and following it for one mile. The deposit is on the property of Dr. L. W. Woody, Sr., Spruce Pine, North Carolina. (Figure 5, Location 30).

The deposit has been prospected rather thoroughly for kaolin. There are two tunnels west of the creek in which the alaskite is exposed. In the summer of 1950 the body was drilled with hand augers on approximately 50 foot centers to determine kaolin grade and reserves.

The largest and most accessible amount of material appears to be in the immediate vicinity of the tunnels and on the north side of the road to east. The material is fine grained, averaging about 2.5 percent plus 8 mesh mica, with a total mica content that will average from 16.0 to 18.0 percent.

It is difficult to estimate the depth of weathering which undoubtedly varies considerably. However, some soft material should be encountered to a depth of 40 or 50 feet and possibly to a greater depth in places.

It is estimated there are between 400,000 and 500,000 tons of ore in the deposit.

Other areas of alaskite along Graveyard Creek, now covered with loose rock and soil overburden, may be weathered to sufficient depth for mining.

Sample Results:

Sample No.	*Plus 8 Mesh Mica*	*Minus 8 Mesh Mica*	*Total Mica*
1	1.5%	11.8%	13.3%
2	3.6	19.7	23.3
3	1.8	18.3	20.1
4	4.9	12.0	16.9

Sample No. 1. Trench sample taken from the lower tunnel located above the old road.

Sample No. 2. Composite sample from twelve hand auger holes on approximately 50-foot centers along a N45°W line 50 feet above the lower tunnel.

Sample No. 3. Composite sample from eleven hand auger holes on approximately 50-foot centers along a N45°W line 100 feet above the lower tunnel.

Sample No. 4. Composite sample taken from six hand auger holes and the upper tunnel. The holes were on approximately 50-foot centers on a N45°W line near the upper tunnel.

Silver Run Creek Area

Two large areas of weathered alaskite occur adjacent to Silver Run Creek, 2 miles S5°E of Spruce Pine. The deposits are on the property of Mr. S. T. Henry of Spruce Pine, North Carolina. (Figure 5, Location 32).

Weathered alaskite occurs on both sides of Silver Run Creek from 100 to 200 feet southwest of N. C. Highway No. 26. The larger area is on the north side of the creek. Here the alaskite is approximately 800 feet long and 600 feet wide and appears to be weathered to sufficient depth for mining. However, indications are that the maximum depth of weathering does not exceed 35 or 40 feet and may not be that deep.

On the south side of the creek some hard feldspar was encountered in all the hand auger holes. It is very likely that hard rock will be encountered at a shallow depth over a considerable area.

The total mica content of the weathered alaskite on the north side of the creek averages from 12 to 14 percent. Material from the south side of the creek averages approximately 10 percent.

It is estimated there are between 1,000,000 and 1,500,000 tons of ore in the deposits. Weathered alaskite is likely to occur under some of the loose rock and soil overburden found along Silver Run and Grassy Creeks but was not considered in the determination of reserves.

Sample Results:

Sample No.	*Plus 8 Mesh Mica*	*Minus 8 Mesh Mica*	*Total Mica*
1	0.0%	11.1%	11.1%
2	0.0	14.1	14.1
3	0.0	10.5	10.5

Sample No. 1. Composite sample from five hand auger holes on the north side of the creek. Three holes were near the fence on 100-foot centers and two holes were near the center of the field.

Sample No. 2. Composite sample from two hand auger holes, one near the fence and one near the center of the field, on the north side of the creek.

Sampl No. 3. Composite sample from six hand auger holes drilled at random in the field on the south side of the creek.

Grassy Creek Deposits

The deposits are on the northwest side of Grassy Creek, 1.9 miles S25°E of Spruce Pine. (Figure 5, Location 31). They are on the property of Mr. W. M. Wiseman of Spruce Pine. Three large kaolin pits occur in the deposit, as do numerous prospect pits.

The portions of weathered alaskite exposed in the old workings contain a lower percent of mica than is generally found in this part of the district, averaging only 10 or 12 percent. Some material containing a higher percent of mica is exposed in small prospects east of the large pits, although the extent of this material could not be determined because of overburden. Some of the mica has a greenish color and may have a high specific gravity.

A large part of the area adjacent to Grassy Creek and near the old pits is covered with loose rock and soil, therefore, no tonnage estimate is given for the area.

Sample Results:

Sample No.	*Plus 8 Mesh Mica*	*Minus 8 Mesh Mica*	*Total Mica*
1	0.0%	11.5%	11.5%
2	0.0	9.6	9.6
3	1.8	13.7	15.5

Sample No. 1. Trench sample from the southern pit.

Sample No. 2. Trench sample from the northern pit.

Sample No. 3. Dump material at a small prospect pit on the northeast side of the old road approximately 0.2 of a mile southeast of the large pits.

Other Deposits

Kaolin has been mined from a rather large deposit near the Club House, 0.5 of a mile southeast of Spruce Pine. The weathered alaskite, in general, contains a relatively low percent of mica. Some of the mica is green and probably has a high specific gravity.

A trench sample from the large open cut back of the Club House contained no plus 8 mesh mica and 10.6 percent total mica.

Numerous zones of weathered alaskite occur north of the Prison Camp. These zones vary in size, mica content, and depth of weathering. Most of the material is fine grained.

Sample Results:

Sample No.	*Plus 8 Mesh Mica*	*Minus 8 Mesh Mica*	*Total Mica*
1	1.5%	13.7%	15.2%
2	1.4	18.9	20.3

Sample No. 1. Trench sample taken over a distance of approximately 75 feet from the road bank 0.3 of a mile northeast of the Prison Camp.

Sample No. 2. Trench sample from a zone of weathered alaskite approximately 70 feet wide which traverses the gravel road 0.5 of a mile N15°W of the Prison Camp.

SULLINS CREEK DEPOSIT

The deposit is located in the southern part of Mitchell County, 1.1 miles N17°W of Spruce Pine. (Figure 5, Location 33). It can be reached from N. C. Highway No. 26 by following the Sullins Creek road 0.5 of a mile north. Harris Clay Company has been mining kaolin from this deposit and producing mica as a by-product for about eight years.

The major part of weathered alaskite is west of the road and extends in some places beyond the old road on the crest of the ridge. It is approximately 1200 feet long and up to 800 feet wide with an average width of about 500 feet. There is a zone of weathered material from 200 to 300 feet wide on the small ridge east of the road.

Some rather large schist inclusions occur near the crest of the ridge but do not occur in sufficient numbers to interfere greatly with mining. The deposit is weathered in places to a depth of 60 feet or more.

The alaskite is relatively coarse grained for a deposit of this size and contains a high percent of mica. Three samples taken from the deposit contained an average of 5 percent plus 8 mesh mica and 17.9 percent total mica.

The deposit is estimated to contain from 800,000 to 1,200,000 tons of ore having an average mica content of around 17 percent.

Sample Results:

Sample No.	*Plus 8 Mesh Mica*	*Minus 8 Mesh Mica*	*Total Mica*
1	5.0%	13.5%	18.5%
2	5.2	11.1	16.3
3	4.8	11.2	16.0

Sample No. 1. A trench sample taken from the upper open cut over a distance of approximately 150 feet.

Sample No. 2. A trench sample from the lower open cut taken over a distance of approximately 200 feet.

Sample No. 3. A sample from numerous drill holes on Mr. Edgar Sparks' property and submitted by Mr. Sparks.

THREEMILE CREEK DEPOSIT

This deposit is in Avery County, 1.4 miles N65°E of Ingalls on the side of the ridge southeast of Threemile Creek. It is on the property of Sam Smith, Ingalls, North Carolina. (Figure 5, Location 34).

Two small prospect pits, about three feet deep, have been made in the deposit. The alaskite is about 150 feet wide and like most others in the area is relatively fine grained. However, local zones of coarser material are quite common. One sample was taken which contained 6.7 percent plus 8 mesh mica, although the average for the deposit is estimated to be around 3 percent.

Some semi-kaolinized feldspar was encountered and it is likely that hard rock will be encountered at a depth of 20 feet or less.

Sample Results:

Sample No.	*Plus 8 Mesh Mica*	*Minus 8 Mesh Mica*	*Total Mica*
1	6.7%	8.0%	14.7%

Sample No. 1. A composite sample from six hand auger holes taken across the strike of the deposit on the side of the ridge near the two small mine pits.

FRANKLIN-SYLVA DISTRICT

The Franklin-Sylva district, in the Mountain province of North Carolina, is about 35 miles southwest of Asheville. It consists of a northeasterly trending belt 14 miles wide and 40 miles long which extends from the Clay-Macon County Line northeastward through Macon and Jackson Counties to Hazlewood in Haywood County. Franklin and Sylva are the principal towns and are the centers of the mining industry. This district ranks second only to the Spruce Pine district in record of production. The scrap mica resources differ from those in other areas in that they are restricted to pegmatite occurrences. Although this seriously limits reserves, the quality of the mica is above the average and is highly desirable for wet grinding.

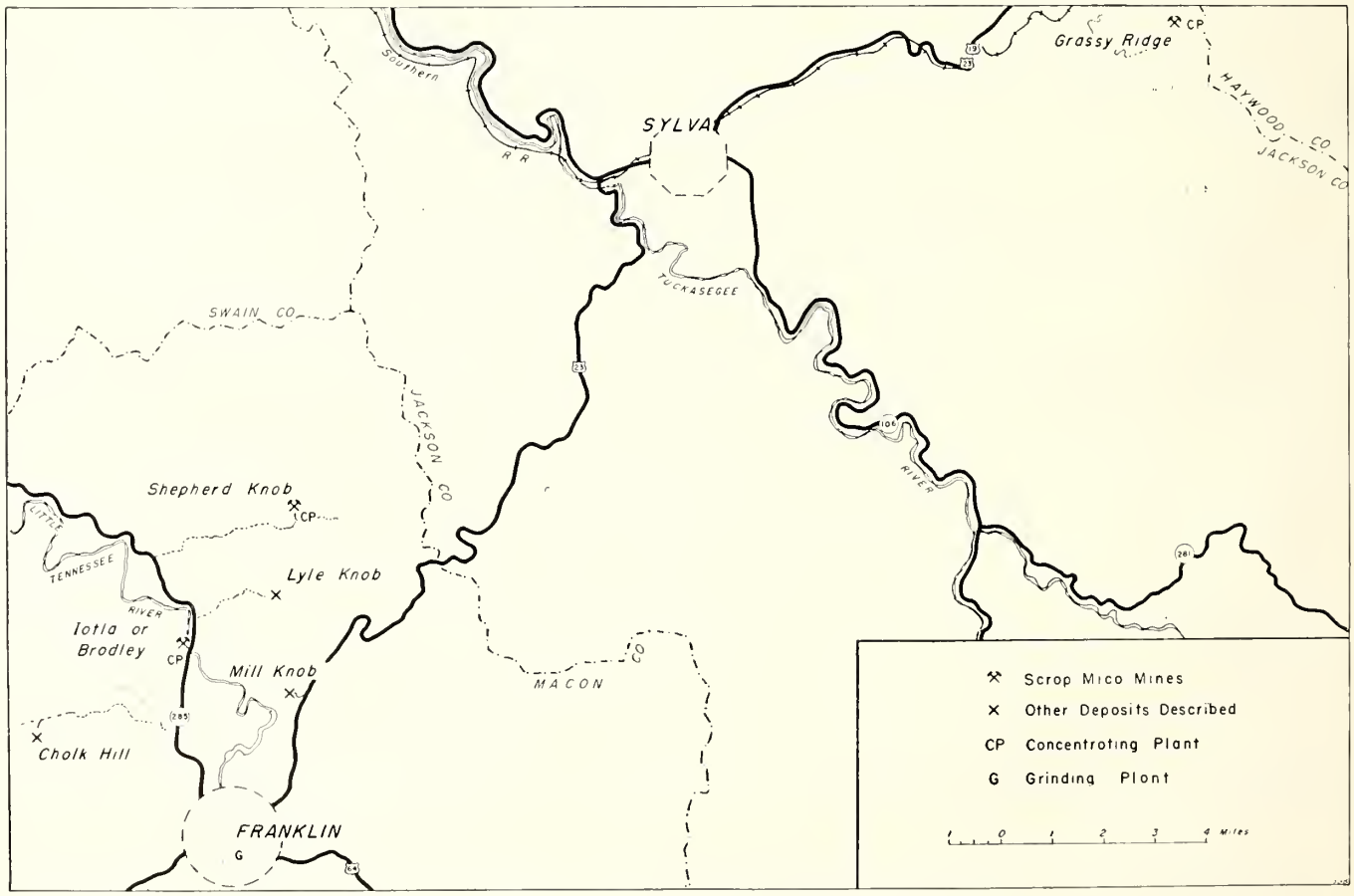


FIGURE 6. LOCATION MAP—FRANKLIN-SYLVA DISTRICT.

GEOLOGIC SETTING

The most prevalent rock formation underlying the district is a series of folded and faulted gneisses and schists, in places interlayered with hornblende gneiss and schist. Pegmatites intrude these rocks over a wide area. No large granite masses are in the immediate district. However, they are present in the Cashiers district, a few miles to the southeast, and may represent the source of the solutions forming the pegmatites. Throughout the region the prevailing formational strike is northeastward and the dip steeply southeastward, although many variations occur locally. The trends of the pegmatites are quite erratic and are possibly controlled by structural features.

Pegmatites are widespread throughout the district, over 325 of them having been worked for sheet mica. These bodies range in size from mere stringers filling joints and slippage zones to large massive intrusives which have disrupted and altered the surrounding country rock. Most of the pegmatites have steep dips, usually ranging from 45 to 90 degrees. Contacts vary radically and often roll to such a degree that they are hard to follow. In places they are sharp and distinct, while in others they are gradational and no sharp line of demarcation can be made. Inclusions of country rock are common. The larger pegmatites, where highly weathered, constitute the primary scrap mica deposits of the Franklin-Sylva district.

Mineralization of these bodies appears somewhat complex and was probably accomplished in stages. Many minerals are present, although feldspar, quartz, and mica predominate. Muscovite is the prevailing type of mica, making up from about 5 to as much as 20 percent of the rock. In the smaller deposits the mica often occurs concentrated along wall zones, adjacent to quartz cores, and in narrow restricted zones or "shoots" running at various angles throughout the body. Such pegmatites often carry high grade sheet mica but are seldom suitable for scrap. In many cases the larger deposits have, in addition to the concentrations described above, small books and flakes of mica disseminated throughout. When the total recoverable mica content is in excess of approximately 8 percent and the pegmatite has suitable volumes of weathered material, the body has possibilities as a scrap mica deposit. In some pegmatites the total mica content will average from 12 to 20 percent.

The mica content varies considerably from one deposit to another and within individual deposits. In general, where a pegmatite has intruded a gneiss or schist containing a high percentage of mica, the reaction with, or digestion of, such material by the pegmatite appears to have increased the amount of mica within a deposit. This is evidenced by large clusters of mica in and around inclusions and adjacent to some contact zones. Where hornblende is the country rock, the biotite content often increases toward contacts and near inclusions.

Muscovite occurs as individual flakes, books, and clusters. It ranges in size from a fraction of an inch to a foot or more in diameter. In most scrap mica pegmatites the general size is from about 1/10 of an inch to 3 inches, with occasional pieces up to approximately 8 inches. Much of the mica is light rum to ruby colored. In the more highly weathered phases of some deposits clay staining is common, and where the mica is in close contact with weathered inclusions or near some contact areas, iron staining is prevalent.

Biotite is present in small quantities in most pegmatites. It occurs as crystals and lath-like strips. As the former it is scattered throughout the deposits as local concentrations and occurs surrounding or being enclosed by muscovite and as individual clusters and books. It is also interlayered with muscovite within a single book. The lath-like bands, occurring singly or in groups, are found cutting zones of massive quartz and feldspar, crossing one another, and cutting the muscovite.

The most highly weathered deposits are usually located on or near the crests of low ridges and spurs, several hundred feet above principal drainage levels. Many deposits are well kaolinized to near these levels and in some instances to greater depths. These pegmatites occurring along the upper steep slopes where erosion is rapid may be weathered at the surface, but hard rock occurs at shallow depths. The average depth of kaolinization in the area is approximately 50 feet, although relatively soft material has been encountered as deep as 200 feet below the surface. Pegmatites which have been mined for their scrap content vary in size from about 10 feet wide and 50 feet long to those several hundred feet wide and as much as a thousand feet long.

DESCRIPTION OF DEPOSITS

The pegmatites described in this section represent the major portion of the reserves of scrap mica in the Franklin-Sylva district. Some of the deposits have largely been worked out but are described for permanent record. Others, offering but limited possibilities, are appraised for future operations. It is recognized that many other pegmatites from which limited amounts of scrap might be obtained are scattered throughout the district. In general they are considered too small as competent sources of scrap mica.

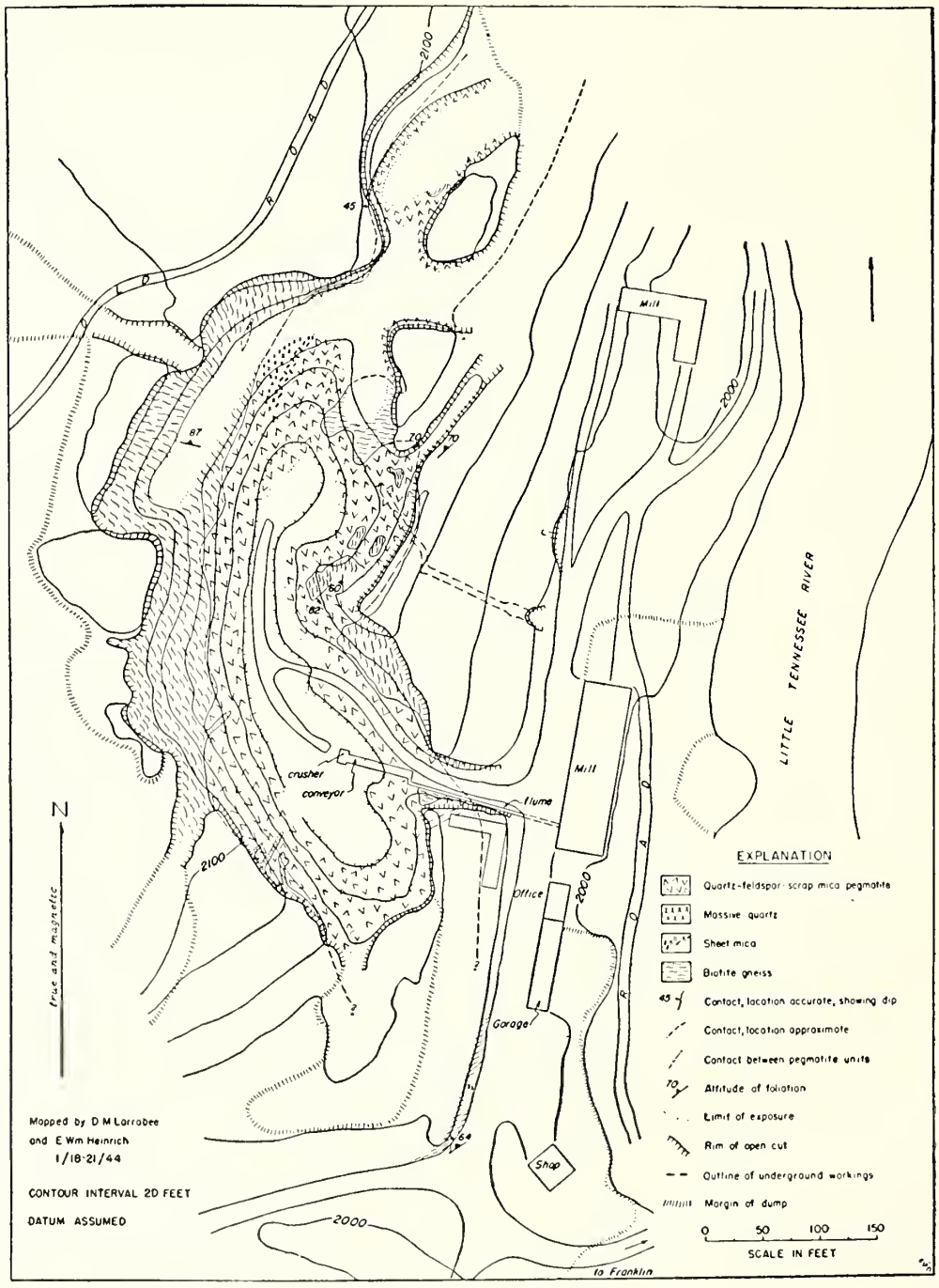


FIGURE 7. MAP OF IOTLA-BRADLEY MINE, MACON COUNTY

IOTLA BRIDGE

The Iotla Bridge or Bradley mine, 4 miles N10°W of Franklin, is on the west bank of the Little Tennessee River, near the mouth of Iotla Creek. It is 300 feet northwest of Iotla Bridge, at the point where N. C. Route 28, the main highway between Franklin and Bryson City, crosses the river.

The deposit shown on Figue 7 is a highly irregular crescent-shaped pegmatite, at least 1000 feet long and in places 200 feet wide, which trends from due north to about N30°E. It appears to have a nearly vertical dip, possibly plunging toward the south or southwest. Inclusions and apophyses of wall rock, usually hornblende or mica gneiss, are common throughout the pegmatite. Weathering is deep as evidenced by the fact that mining has proceeded to a depth of more than 160 feet in the southern part of the deposit, and, although a hardening of the ore is noticeable, no unkaolinized pegmatite was encountered. However gneiss and schist inclusions appear quite fresh in the bottom of the pit. A large quartz core, now nearly mined out, is exposed in the western part of the mine. As exposed, it plunges southward at about 20 degrees and dips westward at a steep angle.

The ore consists of well kaolinized feldspar, quartz, and mica. Small books and flakes of hard clean muscovite, ranging from ½ inch to 3 inches in diameter, are scattered throughout the deposit. Local concentrations of sheet and punch mica are common near the core. Laboratory tests on some of the better grade ore show that the plus 8 mesh mica content is over 22 percent, and it is estimated that the deposit will average from 15 to 18 percent recoverable scrap. Biotite occurs in narrow zones scattered throughout the deposit, being most heavily concentrated near hornblendic inclusions. In places the amount of biotite is excessive. The muscovite, light rum in color, is of an excellent grade for wet grinding.

This deposit, the largest and most continuous source of scrap mica in the district, was first opened about 1905. It has been worked intermittently for over 40 years, and was the mainstay of scrap production for a long period. It was abandoned late in 1947, and when work ceased, the deposit was showing signs of rapid depletion.

The present mine is an open cut about 900 feet long, 200 feet wide, and in places 160 feet deep. Mining had proceeded some 20 feet below river level. Along the western side, the wall, averaging over 125 feet high, is composed of a highly weathered gneiss. Although all of the ore has not been mined out, effective benching of this high wall was too costly to make deeper mining profitable.

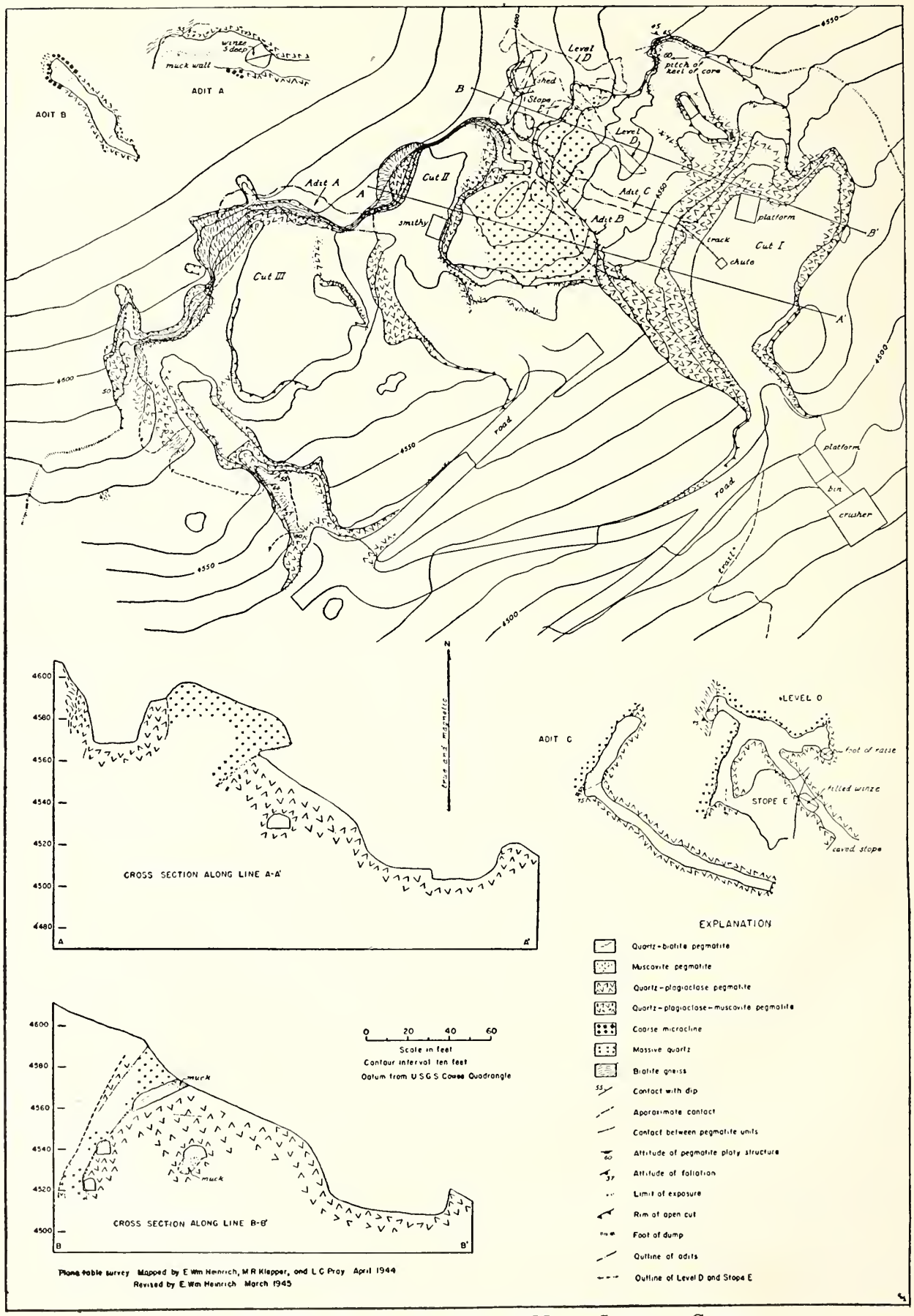
GRASSY RIDGE OR BIG FLINT

This deposit, containing the largest visible reserves in the district, is in Jackson County, about 8 miles N70°E of Sylva and 2 miles S57°E of Balsam. It is located on a very steep slope along the south side of Grassy Ridge and is accessible by a well-graded road leading southeastward from Balsam Station on the Southern Railway. Scrap mica has been produced intermittently since 1932, when A. W. Davis first opened the deposit. The Franklin Mineral Products Company of Franklin, North Carolina, held a lease on the property as late as 1953.

The deposit (see Plate 11) is a large pegmatite which is relatively unweathered but in which zones of semi-kaolinized material occur. Extreme rolling of the northwestern contact makes it difficult to establish the direction of dip. The large quartz core near the northwestern border has an apparent westward dip that may indicate the attitude of the whole deposit. As exposed the pegmatite is about 375 feet long and as much as 300 feet wide.

Mica of excellent quality occurs disseminated throughout most of the deposit, although certain areas are quite lean. For the most part the mica consists of small clean hard books of muscovite which range from 1 to 3 inches in diameter. Biotite is present but not in excessive amounts. E. William Heinrich, who mapped the deposit in 1945, describes the most favorable occurrences of scrap as follows:

> "The mine has been a large producer of scrap mica and considerable quantities of pegmatite rich in scrap remain to be mined. The richest concentrations of scrap mica occur in a belt that is parallel to the trend of the pegmatite body and has a width of about 80 feet along the northwest side of the mass. This belt is estimated to contain between 5 and 10 percent of scrap mica. Beyond this width the content of scrap mica is markedly less. The transition to the scrap-poor part seems to be accompanied by an increase in the percentage of microcline."



MAP AND SECTIONS OF THE BIG FLINT MINE, JACKSON COUNTY.

BULLETIN 66—PLATE 11

Along the northwestern contact, out of the scrap rich belt, some feldspar has been produced.

The scrap mica zone ranges from semi-kaolinized to hard unweathered material. Most mining operations have been in the semi-kaolinized portions where little or no blasting was required. Considerable crushing is necessary to free the mica from its gangue, and the wear on equipment is rather excessive. The future production from the Grassy Ridge deposit will depend largely upon economical mining and milling rather than the usual problem of reserves. Future operators should consider the recovery of both fine mica and feldspar.

MILL KNOB

Mill Knob is 3.2 miles N20°E of Franklin and 0.75 of a mile N15°W of Dean on U. S. Highway 23. This deposit, reported to have been opened by Dr. Jim Lyle about 75 years ago, has been an important producer of sheet mica. The property is owned by A. W. Reid of Franklin, whi supervises the current sheet mica operation for the Capitol Mining Company (1952).

The deposit is an extremely irregular pegmatite which strikes slightly northeast, dips toward the east, and plunges northeast. It is roughly lens-shaped, has a maximum width of nearly 80 feet, and has been worked for over 275 feet along the strike. The present workings consist of an open cut 250 feet long, about 60 feet deep, and from 60 to 100 feet wide. A series of shafts and tunnels extend to nearly 150 feet below the surface. Most of the underground workings are in the soft upper portions of the deposit and are inaccessible. However, soft ore is reported to extend at least 30 feet below the present cut.

Mica is relatively abundant, occurring as clusters and shoots dissiminated throughout large areas in the deposit. Relatively heavy concentrations occur around some of the many mica gneiss inclusions. The muscovite is light rum in color and occurs in books from ½ inch up to 12 inches in diameter. The average size appears to be from 1 to 3 inches. In places the concentration of biotite is high. This biotite mica occurs as intergrowths with the muscovite, as individual books, and as lath-like bands. It is estimated to represent from 2 to 5 percent of the available mica. The total mica content is estimated at from 5 to 10 percent, with local concentrations up to 20 percent.

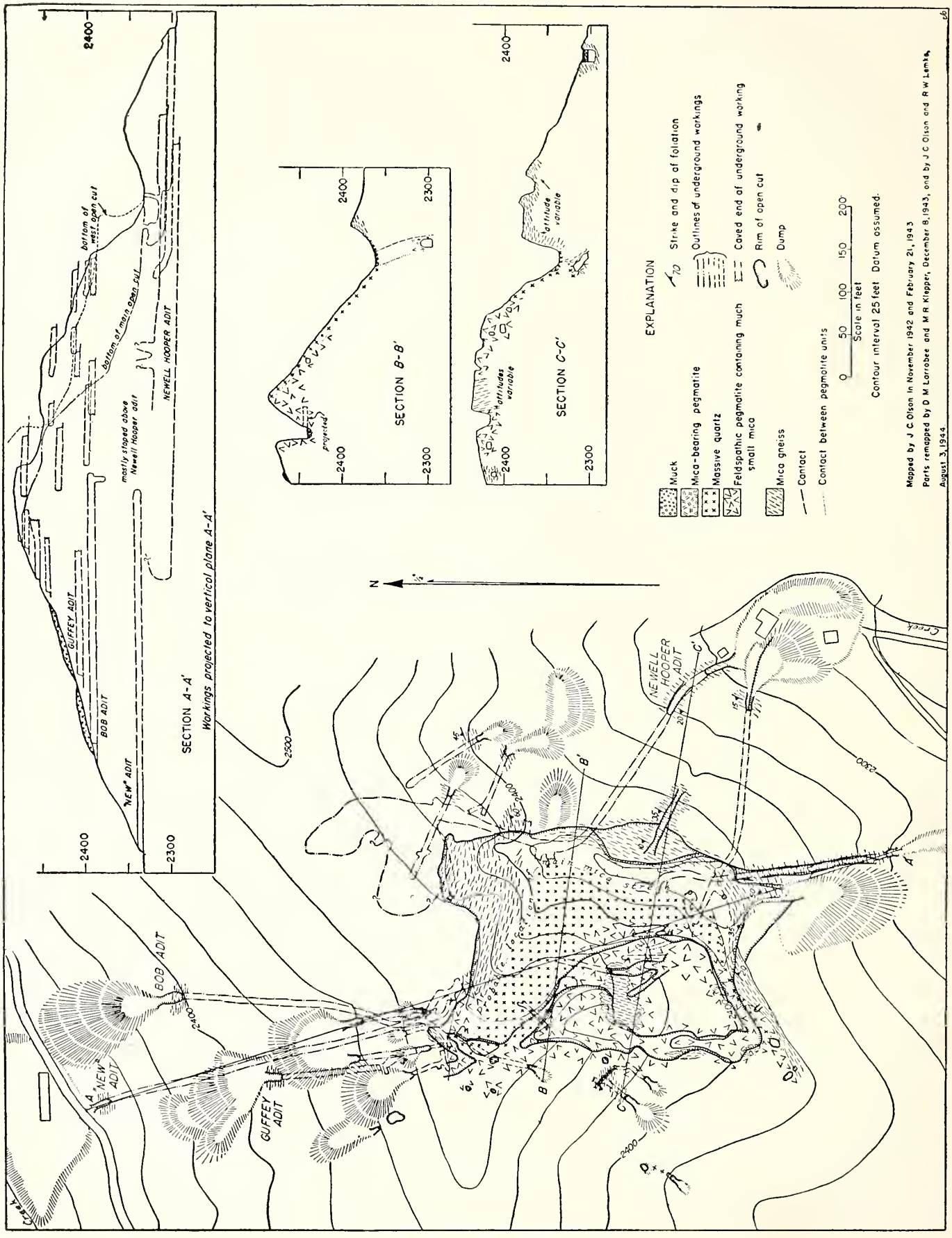
The Mill Knob deposit is considered, in light of present knowledge, to be a marginal deposit. A considerable tonnage of ore remains, but much of the better areas have been mined out. A high quality scrap probably can be recovered during sheet mica mining.

SHEPHERD KNOB

This deposit, 6.5 miles N10°E of Franklin, and 3 miles N72°E of West's Mill, straddles a steep sided east-west spur of Bench Mountain and is about 400 feet above and just north of Caler Fork of Cowee Creek. It is the largest producer of scrap mica in the Franklin-Sylva district and is now being mined by the Macon Mica Company of Franklin (1952).

As shown on Plate 12, the Shepherd Knob pegmatite is roughly plano-convex shaped in outcrop and appears to strike slightly northwest, dip eastward, and plunge northeastward. As exposed it is about 300 feet long, has a maximum width of 250 feet, and is about 150 feet thick. Along narrow U-shaped quartz core parallels the eastern rim and is separated from it by a zone of pegmatitic material averaging from 10 to 15 feet wide and containing an excellent grade of mica. This core has an exposed length of over 575 feet and a thickness of from 10 to 20 feet. Throughout the pegmatite, inclusions of mica gneiss are common, being especially numerous in the western half. The upper portion of the deposit is highly weathered, and the ore well kaolinized. Semi-kaolinized pegmatite is exposed in the lowest underground workings, some 200 feet below the crest of the ridge. The country rock in these lower workings is quite hard.

Mica occurs scattered throughout the pegmatite and makes up approximately 15 percent of the mineable material. About 2 percent of the mica is biotite. West of the core the ore crops out over an area about 200 feet long and 100 feet wide. Here the mica occurs as small books from about ½ inch to 2 inches in diameter scattered throughout the ore. Since the west wall is gradational, there is an increasing number of small stringers or inclusions of wall rock westward from the core. Excessive weathering of these inclusions has caused a widespread staining of the mica and has lowered its desirability for wet grinding.



MAP AND SECTIONS OF THE SHEPHERD KNOB MINE, MACON COUNTY.

The highest grade ore lies along the eastern side of the core and forms a narrow zone about 15 feet wide between the core and wall rock. This zone has been extensively mined for both sheet and scrap and much of the more easily accessible material removed. However a sizeable tonnage still remains at approximately 50 feet below the present open cut. As exposed the ore contains from 12 to 18 percent muscovite, with little biotite. If the quartz core is playing out at this depth, as conditions indicate, the width of this mica rich zone may increase below the core. In places the core zone contains a high percentage of burr mica in a readily friable quartz. This mica probably can be concentrated profitably.

The Shepherd Knob deposit appears to be narrowing at depth, and although there are considerable reserves remaining, the recovery of scrap may be uneconomical within the next few years if the present rate of production is maintained.

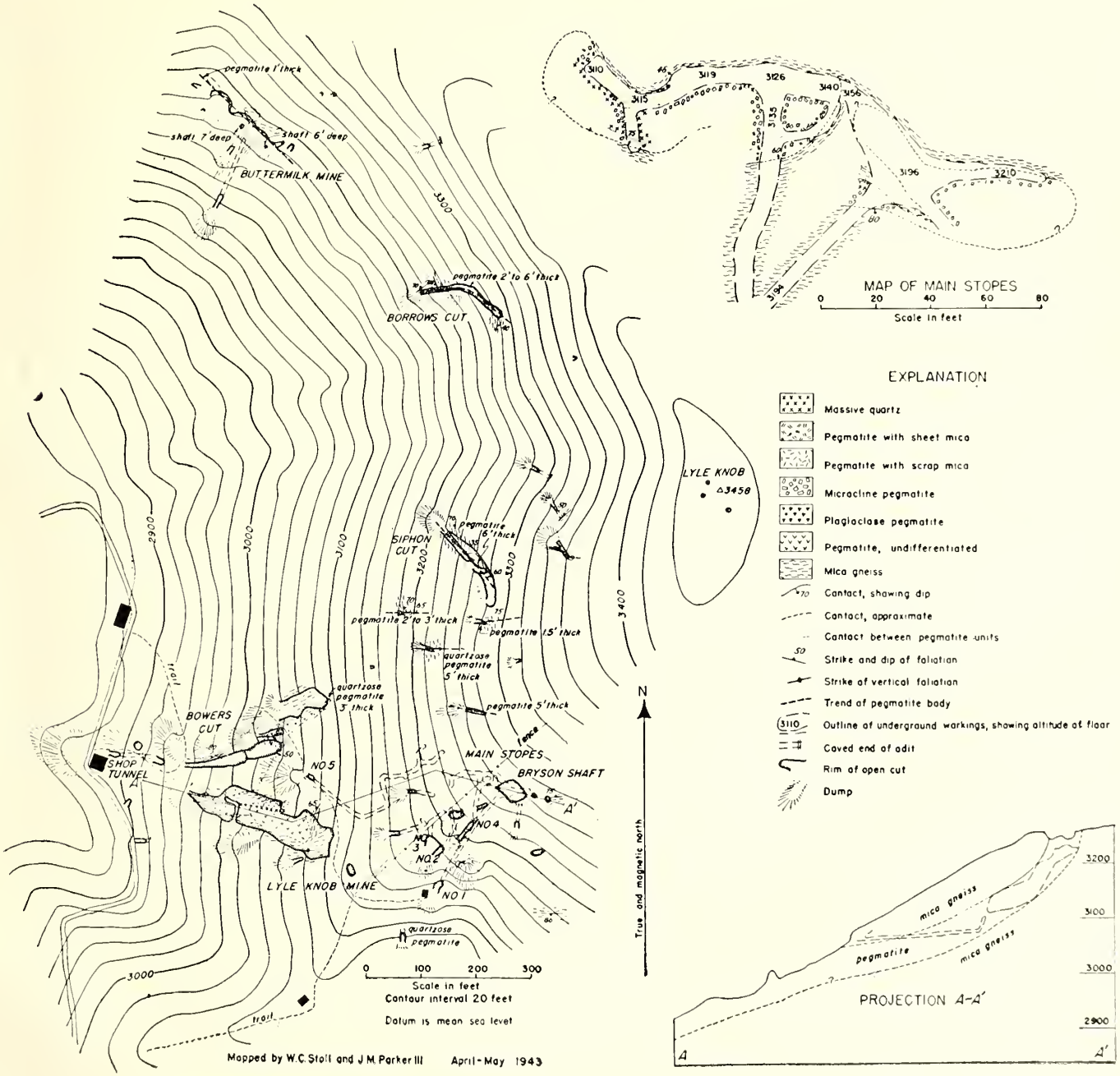


FIGURE 8. MAP AND SECTIONS OF THE LYLE KNOB MINE, MACON COUNTY.

LYLE KNOB

Several pegmatites have been worked for mica on Lyle Knob, 4.9 miles N12°E of Franklin, Macon County. (See Figure 8). Most of the production has been sheet mica and feldspar, although certain areas have been worked for scrap mica. The latest major production of scrap is reported to have been done in 1943 by the National Mica Company. In 1947, the Mica Products Corporation did considerable prospecting on the property but produced only a small amount of scrap.

The pegmatites on Lyle Knob range from a few feet to as much as 40 feet in width and in places have rich concentrations of mica. The larger bodies have been quite extensively worked for sheet mica and feldspar. Most of the pegmatites are not deeply weathered and the scrap possibilities are limited.

There have been no pegmatites suitable for a sizeable scrap mica operation as yet uncovered at Lyle Knob. The principal pegmatite, about 40 feet thick, is well kaolinized in its lower part, but much of the available ore has been removed. Recently 8 bulldozer cuts were made along the southern end of the Knob. These cuts exposed several small pegmatites from 0.5 foot to 3 feet thick, some rich in scrap. However, none of sufficient volume to be considered as scrap mica deposits has as yet been found.

Although mica of scrap grade occurs on Lyle Knob, available tonnages are low. That which does occur is a hard, fresh ruby mica of excellent grade.

CHALK HILL

The Chalk Hill mine is at the mouth of Carson Cove, 4.5 miles N62°W of Franklin, Macon County, and 1.3 miles east of Iotla Gap. It is located along the lower northern slopes of Trimont Ridge, about 175 feet above and south of Iotla Creek. The mine has been a limited producer of high-grade scrap and sheet mica. A scrap plant was erected on the property during the early 1930's by A. W. Reid, but operations were discontinued because of legal entanglements. Since that time the property has been prospected both sheet and scrap, and some good grade sheet produced.

The deposit consists of a series of closely spaced east-west trending pegmatites which have been explored by pits and tunnels over a narrow area about 0.5 of a mile long. At no place has a large body been exposed. Apparently the largest pegmatites are at the western end of this line of workings, and they have been prospected over an area about 750 feet long and 300 feet wide.

In this area several pegmatites, ranging in width from 2 to 20 feet, have been worked by open cuts, shafts, and tunnels. The largest continuous exposure is near the top of the hill where an open cut 50 feet long, 25 feet wide, and 20 feet deep shows pegmatitic materials throughout. The scrap content of the pegmatite at this locality is low, but the mica is of good quality. Other pegmatites, a short distance west of the open cut, have been worked extensively for sheet mica. These are quite narrow. Most of the exposed areas are well kaolinized.

The mica is relatively abundant throughout most of the pegmatites, although in none of the present exposures does it appear to exceed 10 percent. It is reported to be abundant in the large pegmatite near the top of the hill but, as exposed in the open cut, averages from 5 to 8 percent. The mica, for the most part, is light to deep rum colored muscovite, relatively unstained, and of excellent quality for wet grinding. Although Chalk Hill deposit does not compare in size with some of the larger ones in the district, it does contain an excellent quality mica which may be economically produced on a limited scale.

OTHER DEPOSITS

There are many small highly weathered deposits scattered throughout the district. In some instances where several such pegmatites occur in the same vicinity, they might be worked profitably. A series of such deposits occur south and west of Franklin. Of these the Upper Bryson, Berry, and old May Mines may have possibilities of a limited scrap production. The available tonnage from each deposit is small and would not warrant the erection of a washer plant.

SHELBY DISTRICT

The Shelby district, located in the southwestern part of the Piedmont region, embraces a large area that includes most of Cleveland County and parts of western Lincoln and Gaston Counties. It is from 20 to 25 miles wide and approximately 30 miles long. The most promising scrap mica areas are in the southeastern part of the District, in the vicinity of Kings Mountain.

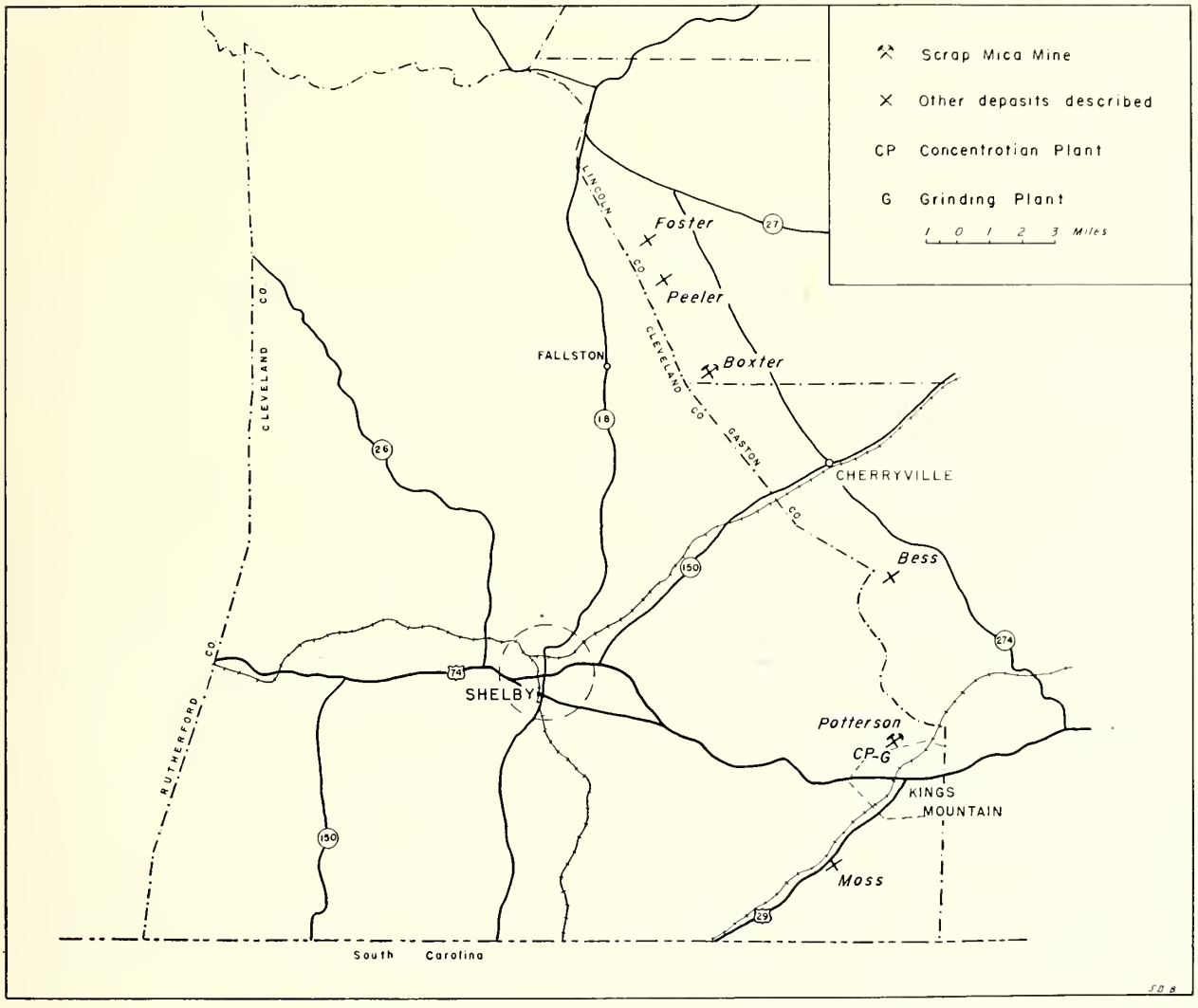


FIGURE 9. LOCATION MAP—SHELBY DISTRICT

Although sheet mica has been mined sporadically for over 75 years in the Shelby district, only within recent years have deposits been worked primarily for their scrap content. In 1943 the first concentrating plant was erected by the Victor Mica Company on the farm of John Peeler in western Lincoln County, but the plant was never in operation. In 1947 a washer plant was completed on the Jack Baxter property in southwestern Lincoln County by F. B. Hendricks, and since that time there has been a continuous production of high-grade scrap from the district. At present the only operation is that of the Kings Muontain Mica Company, located just northwest of Kings Mountain in southeastern Cleveland County. This company has one of the largest and most modern scrap mica concentrating plants in the State.

Although the Shelby district has not been thoroughly prospected, indicated reserves appear sufficient for a steady production for some years to come. The mica is of an excellent quality and is highly desirable for wet grinding.

GEOLOGIC SETTING

Rocks of the Shelby district are, for the most part, a series of gneisses and schists which have been intruded and in places assimilated by large granite bodies. At least two ages of granites are indicated. Pegmatites, genetically associated with the granites, intrude the gneiss-schist series and appear as intrusions or segregations in portions of the granites. Most of the rocks are highly weathered to a depth that approaches major drainage levels.

In the southern and western portions of the district, metamorphic rocks predominate. Although the rocks are highly distorted in some localities, there are large areas in which they are quite flat-lying and appear as gently undulating folds. The rocks are composed principally of mica, quartz, sillimanite, sericite, hornblende, and garnet in varying proportions. Toward the northwest the sillimanite content increases until it comprises a major portion of the rocks forming the Sillimanite Belt described by Hunter and White and later by Hash and Van Horn. Numerous pegmatites, containing considerable amounts of potash feldspar, occur throughout this portion of the district. Granitic rocks are common, but exposures are limited.

In the eastern part of the district granite is exposed over large areas, the gneiss-schist series appearing as inclusions or roof pendants within the granite mass. In many instances such inclusions are shallow and have been highly injected with pegmatitic materials. This is especially true in the area south and west of Kings Mountain. Magmatic solutions have also been active along some of the granite contact zones and occasionally within the granite proper. The Tin-Spodumene Belt described by Kesler bounds the district on the southeast.

Mica in commercial quantities occurs in pegmatites and along certain contact zones of some granites. The principal known reserves of scrap mica are confined to the latter type of occurrence.

The mica bearing pegmatites of the Shelby district are similar to those found in other mica districts in North Carolina. They occur widely scattered, both singly and as small groups, throughout the district but are larger and more numerous in the northern and western areas. In most cases they are generally quite close to granite bodies, usually within 0.5 of a mile. Surface outcrops are limited and unpredictable. Many of the pegmatites strike northeastward and plunge northwestward. Although they vary from a few inches to 30 or more feet in width, the average is from 2 to 5 feet. No large mica-bearing pegmatites, such as those found in the Franklin-Sylva district, have been found in the Shelby district. Many of the bodies are somewhat pod shaped, have steep plunges, erratic rolls, and tendencies to play out rapidly at depth. Some of the larger pegmatites contain little scrap mica, while many of the smaller ones are often rich. Few contain sufficient reserves to be considered as primary scrap mica deposits.

Mica occurs in all granites, but its presence in commercial quantities is limited to certain areas where enrichment by magmatic solutions is in evidence. Most prominent of these areas is along the border zones of granite bodies, especially in the southeastern part of the district. Here a large fine to medium-grained light gray to white granite is well exposed between Shelby and Kings Mountain. This body trends in a general northeasterly direction and is from 1 to 4 miles wide.

The southeastern border phase of the granite and the adjacent gneiss-schist series have been subjected to magmatic solutions which caused relatively high concentrations of muscovite mica to be formed locally. This zone, approximately 1 mile wide and over 4 miles long, is well exposed along U. S. Highway 29 southwest of Kings Mountain. It crops out as two belts of granite separated by a narrow irregular band of mica-sericite gneiss. Indications are that the gneiss is probably a roof pendant in the granite mass and is quite shallow. It has been highly injected with pegmatites throughout its length and width, and large concentrations of pegmatitic material occur along the gneiss-granite contact. Most of the pegmatites in the gneiss are small but are rich in fine mica. High mica concentrations also occur in the granite along the contact area but rapidly diminish away from the gneiss belt. The largest indicated reserves of scrap are in this area but are not necessarily confined to it.

The mica in the Shelby district is a light brown to ruby muscovite of high quality. That from the weathered portions of the deposits usually delaminates readily during grinding and is a very desirable product for scrap. Zones of biotite occur in most deposits but usually present no serious problems.

Pegmatites in general contain coarser mica than do granites, much of that from the former being larger than ⅛ inch in diameter. Some deposits contain as much as 18 percent mica above this size. In the granites and along contact zones the mica is quite fine, a large percentage being less than 1/16 inch in diameter. In many deposits only from 3 to 5 percent is larger than ⅛ inch, while the total mica content of the ore may run as much as 20 percent.

DESCRIPTION OF DEPOSITS

The properties described in this section represent some of the more outstanding in the district. Those deposits of the granite-contact type offer the best possibilities as primary scrap mica deposits. The pegmatites described are presented as typical of those occurring throughout the district. Most of these bodies are too small to be worked for their scrap content, although a considerable amount might be obtained as a by-product of sheet mica mining.

J. BUN PATTERSON

This property, located a few hundred yards east of Potts Creek, is approximately 1.3 miles N12°W of the intersection of U. S. Highways 29 and 74 in Kings Mountain, Cleveland County. It is held under lease by F. B. Hendricks of the Kings Mountain Mica Company and is the only property currently being worked in the district.

The deposit is of the granite contact type and is very irregular in outline. It appears to have a northeasterly trend, although actual contacts are difficult to delineate. However, it has been mined over an area approximately 450 feet wide and 800 feet long, and is known to extend for a considerable distance beyond the present mine workings. Overburden is light.

Essentially the deposit is a portion of the contact zone between a large granitic intrusive and mica schist and gneiss. The ore is a fine to medium-grained granitic rock composed principally of plagioclase feldspar, quartz, and musocovite mica, with minor amounts of potash feldspar, biotite, and garnet. Segregations of pegmatitic materials are common throughout the granite, usually being quite narrow and erratic. Inclusions of mica gneiss and schist are prominent and range from small bodies less than a foot wide, which are extremely contorted and contain many pegmatite stringers, to those twenty or more feet wide, which show little alteration and contain but few pegmatites. In many instances the large inclusions are quite shallow, often less than 20 feet thick and are underlain by granite. In some parts of the deposit there are indications that considerable amounts of the originally included country rock has been digested by the granite. The deposit is well kaolinized to about 35 feet below the surface. Stringers of halloysite are present in many parts of the deposit but are most abundant near the southeastern part of the mine.

Muscovite occurs throughout the deposit but is larger and more highly concentrated along the pegmatitic zones and adjacent to the inclusions. Away from these areas the mica is usually very fine, much of it being less than 8 mesh in diameter. Some portions of the deposits are relatively barren, while others are extremely rich. It is estimated that the mica content will average from 6 to 10 percent throughout the deposit. At the present time mica concentrates from this deposit are among the most desirable for wet grinding purposes now being produced in North Carolina.

Mining is carried out by drag pans and the ore passed through a conventional washer plant where the coarse mica (+⅛ inch) is concentrated. Rejects from this plant are settled in large ponds and later pumped to the spiral concentrator plant where the fine mica is removed. After concentration the mica is processed by either wet or dry grinding methods.

CHARLIE MOSS

A large deposit of scrap mica is on the property of Charlie Moss, located in Cleveland County, on U. S. Highway 29, about 2.5 miles southwest of Kings Mountain. It is well exposed in the highway cuts and along the secondary road south of the highway.

This occurrence is of the granite-contact type and represents one of the largest known deposits in the district. Since it is very irregular and contacts are gradational, no definite bounds could be determined.

However, it has been prospected for over 700 feet northeastward along the strike and is exposed for more than 300 feet normal to the strike. The best exposed contact is with a gneiss approximately 325 feet south of the highway and along the secondary road. However, the contact does not persist, and the ore grades into granite northeastward. Schist inclusions are common. Nine auger holes averaging 16 feet deep were bored to determine the subsurface characteristics of the deposit.

The ore is a highly kaolinized granitic rock of which muscovite mica makes up approximately 15 percent by weight. In most cases the mica is very fine, usually less than ⅛ inch in diameter. Larger mica, from ¼ inch to 3 inches in diameter, occurs as books and flakes concentrated around schist inclusions and quartz stringers. Such concentrations often contain as much as 25 percent mica. Biotite is present in small amounts but does not appear prohibitive.

The ore is soft and has from 1 to 5 feet of clay overburden. Its depth has been proved to 20 feet, but it is expected to extend to nearly twice this depth. Water wells drilled in the area encountered hard rock at approximately 40 feet. This deposit is considered to have excellent possibilities for scrap production. Northeastward from the Moss property and north of the Southern Railway, surface indications appear favorable for scrap, and this area justifies further examination.

JACK BAXTER

The Jack (Thomas) Baxter Mine, about 0.5 of a mile N62°E of the southwestern corner of Lincoln County, and 3 miles east of Fallston, Cleveland County, is one of the oldest mines in the Shelby district. It is reported to have been worked for sheet mica prior to 1870. During 1947, F. B. Hendricks opened the mine for scrap and worked it until 1948. It was abandoned after the ore body became too small to work, and the mine, a large open cut, was back-filled.

The deposit was a pod-like pegmatite about 20 feet wide and 75 feet long at the surface. It had a strike of N30°E and plunged steeply toward the northwest. This funnel-shaped body decreased in size rapidly toward the northwest and at a depth of approximately 50 feet was less than 1 foot wide. The ore was well kaolinized at this depth. A highly weathered garnetiferous gneiss surrounded the pegmatite. The southeastern side and northeastern end appeared well defined, but the northwestern side rolled considerably and the southwestern end was very irregular.

Mica occurred disseminated throughout the deposit, although its greatest concentrations appeared near the borders, adjacent to schist inclusions, and in small pockets within the body. That occurring in and near the weathered inclusions was generally stained, but that away from the inclusions was of an excellent quality. Most of it occurred as small hard books, usually light rum in color, and relatively free of impurities. The average size was from ½ inch to 3 inches in diameter. It was estimated that from 12 percent to 18 percent of the ore was mica larger than ⅛ inch in diameter and that local concentrations exceeded 30 percent.

This mine was the first major producer of scrap in the district and was worked by open-cut methods. Practically all of the pegmatite was removed to a depth of over 50 feet.

SMALL PEGMATITE DEPOSITS

Throughout the Shelby district there are many pegmatites which have been mined for sheet mica, and from which some high-grade scrap has been recovered. Over 30 of the mines were visited during the present investigation, and inspections were made as to the possibilities of producing scrap mica from them. Where indications appeared most favorable, auger holes were drilled to determine the lateral extent of the ore body. Most of the pegmatites visited were less than 20 feet wide, many being less than 3 feet.

Among the more important sheet mica mines in the district are the Foster and Bess (Figure 9), both of which have produced large quantities of mica. Others include the Mull, Baxter Girls, Self, Indiantown, and Mauney. A concentrating plant was erected in 1942 to recover scrap from a mica-rich pegmatite on the John Peeler property (Figure 9). The ore body was not large enough to supply the plant for any sustained period of time, and the plant was never operated.

Sheet mica, sold by the pound, can be mined profitably from small narrow deposits. Scrap mica, sold by the ton, must be present in large quantities to be recovered at a profit. Although the pegmatites in the Shelby district have been a source of high-grade sheet mica, few have sufficient volume to be worked for their scrap content.

OTHER AREAS

The close association of scrap or flake mica with granite-like rocks makes most localities containing large amounts of such rocks potential sources of commercial deposits of scrap mica. There are several areas in North Carolina, other than the three major districts described in this report, in which mica deposits are known to occur. Time did not permit the authors to investigate these occurrences, and, therefore, no evaluation as to their scrap possibilities was made.

Among the more outstanding of these areas are (1) south of Hayesville, Clay County, (2) the Cashier's District, Jackson County, (3) the Sandy Ridge-Price area of Stokes and Rockingham Counties, (4) the Milton area, Caswell County, and (5) various localities in Wake, Granville, and Warren Counties. None of the localities are known to have commercial deposits of scrap mica, although mica-bearing pegmatites are present, and sheet mica has been produced from all the areas at various periods. Since some of the occurrences are rather far removed from the present mica-grinding industry, the potential value of scrap deposits within such areas will, in many cases, be controlled largely by economic factors.

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